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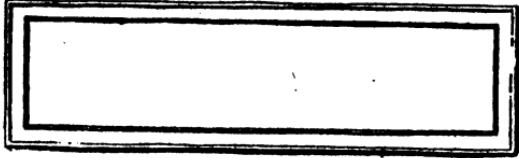
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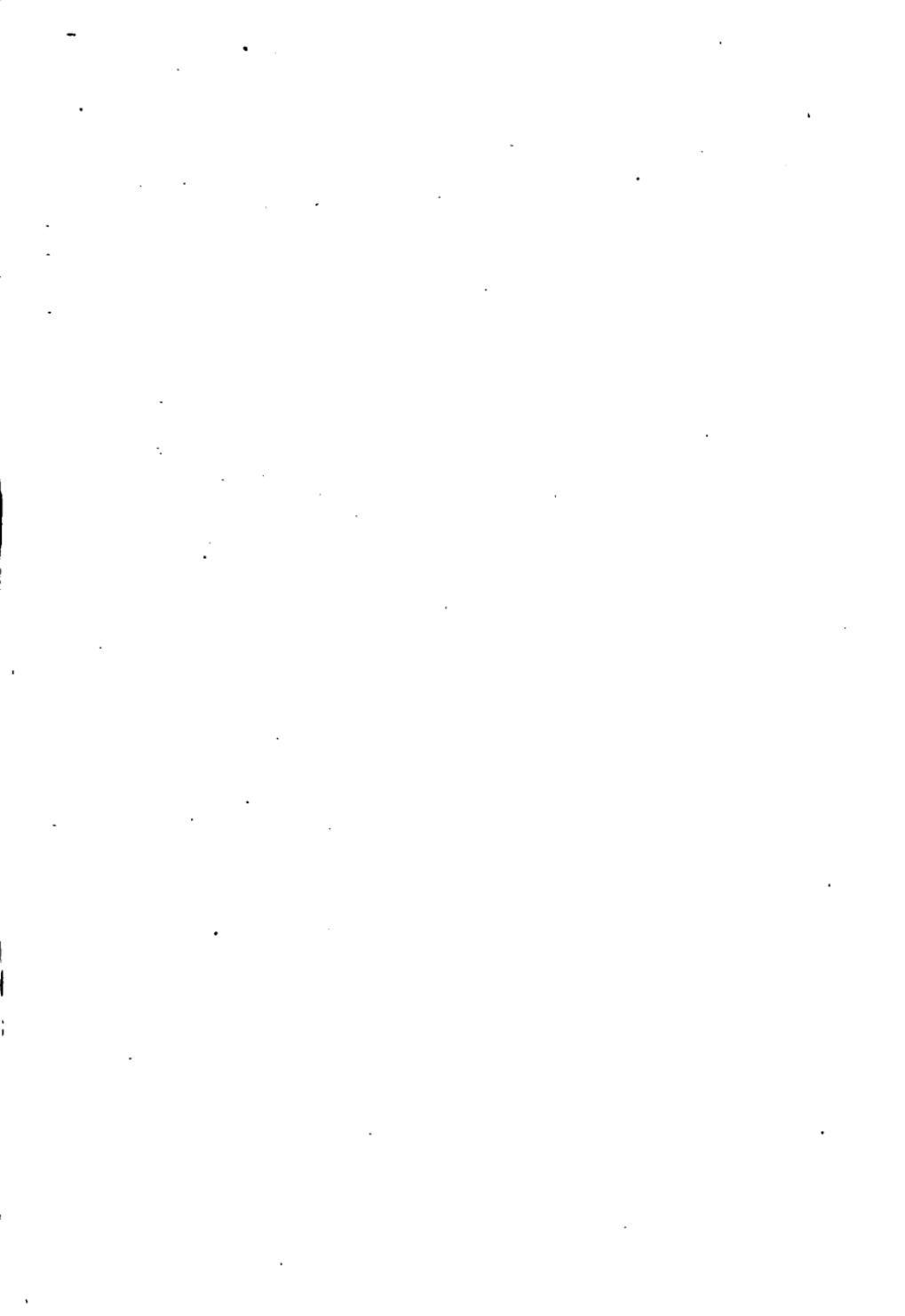
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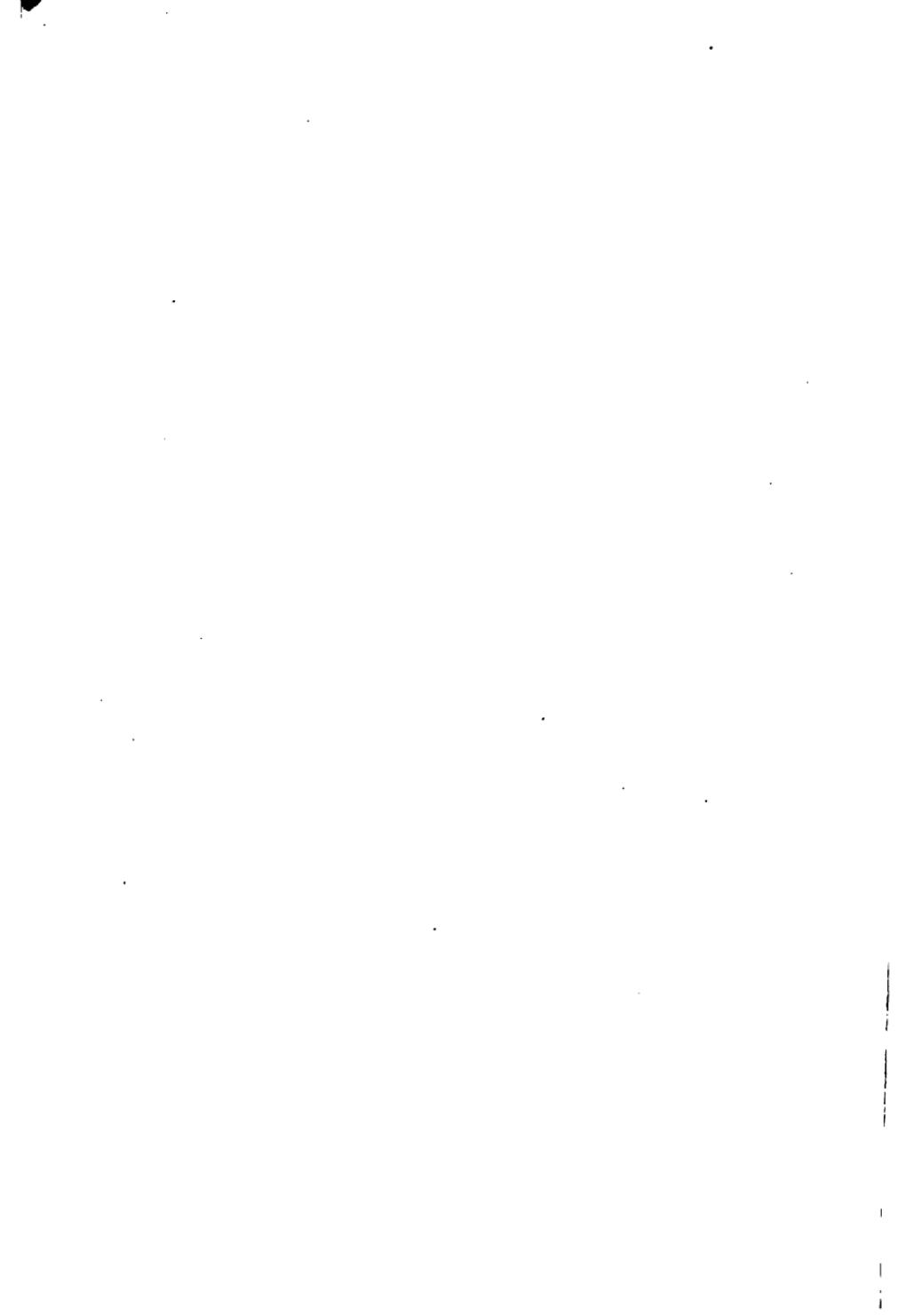
OVER the DRAWING BOARD

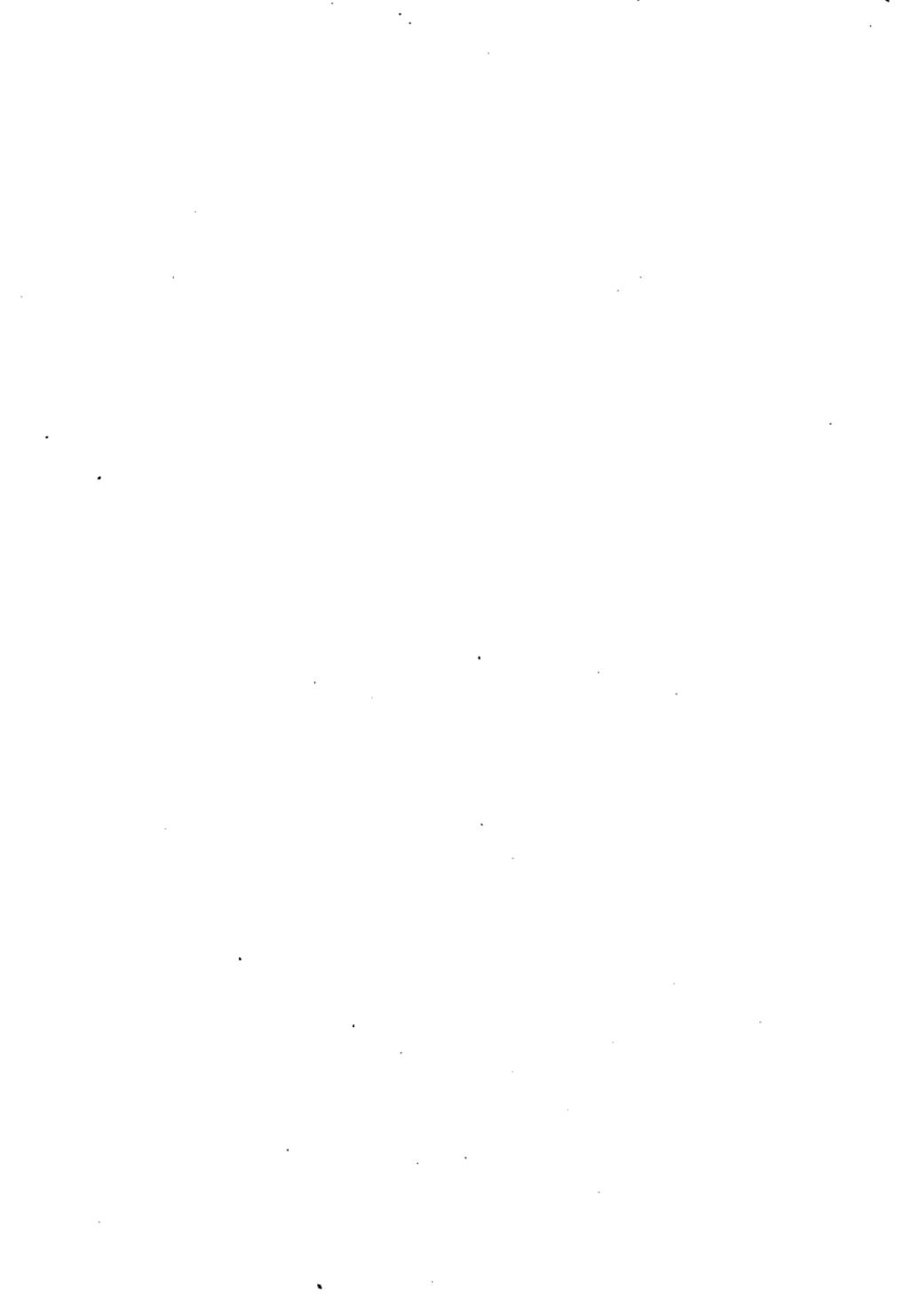
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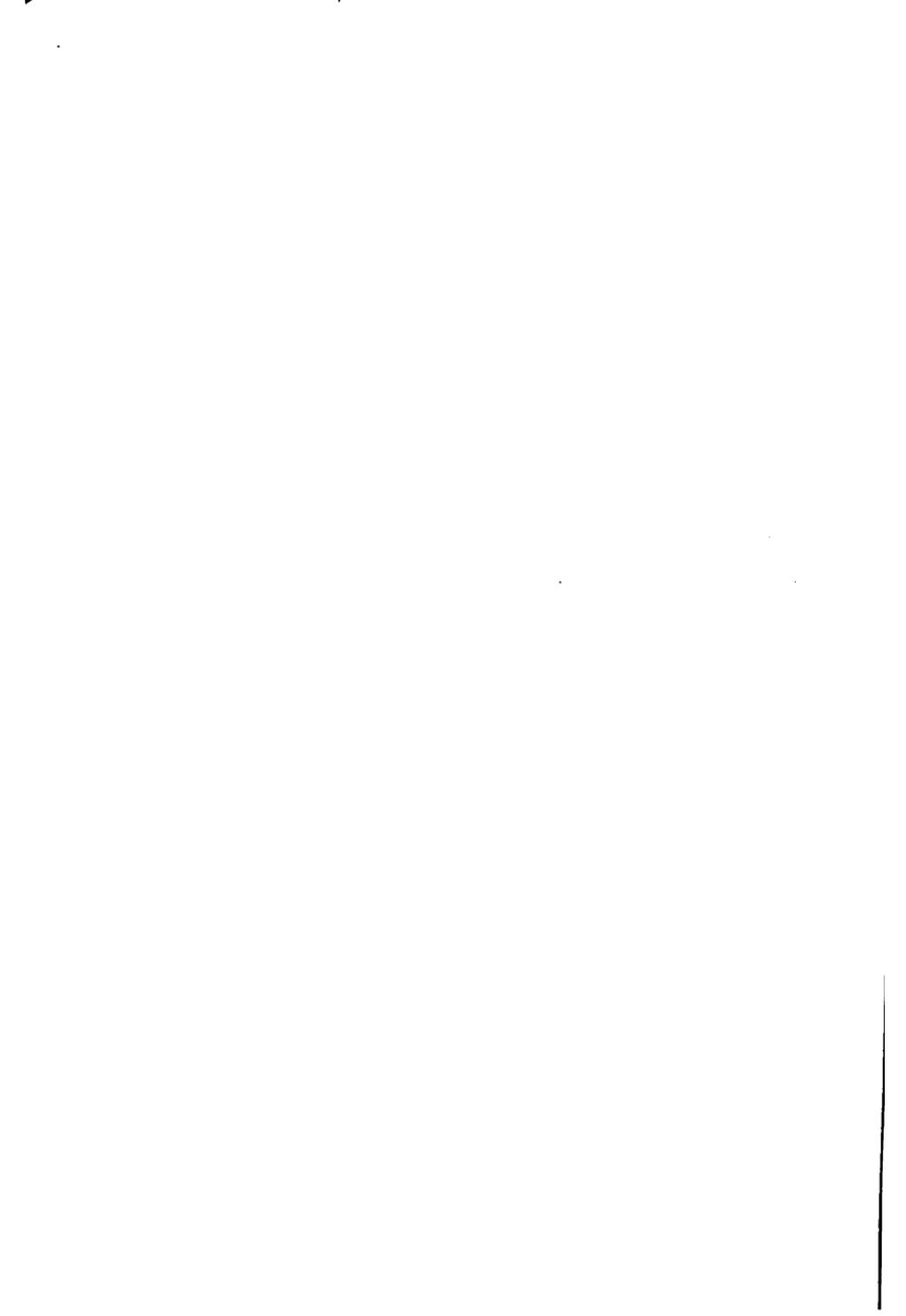
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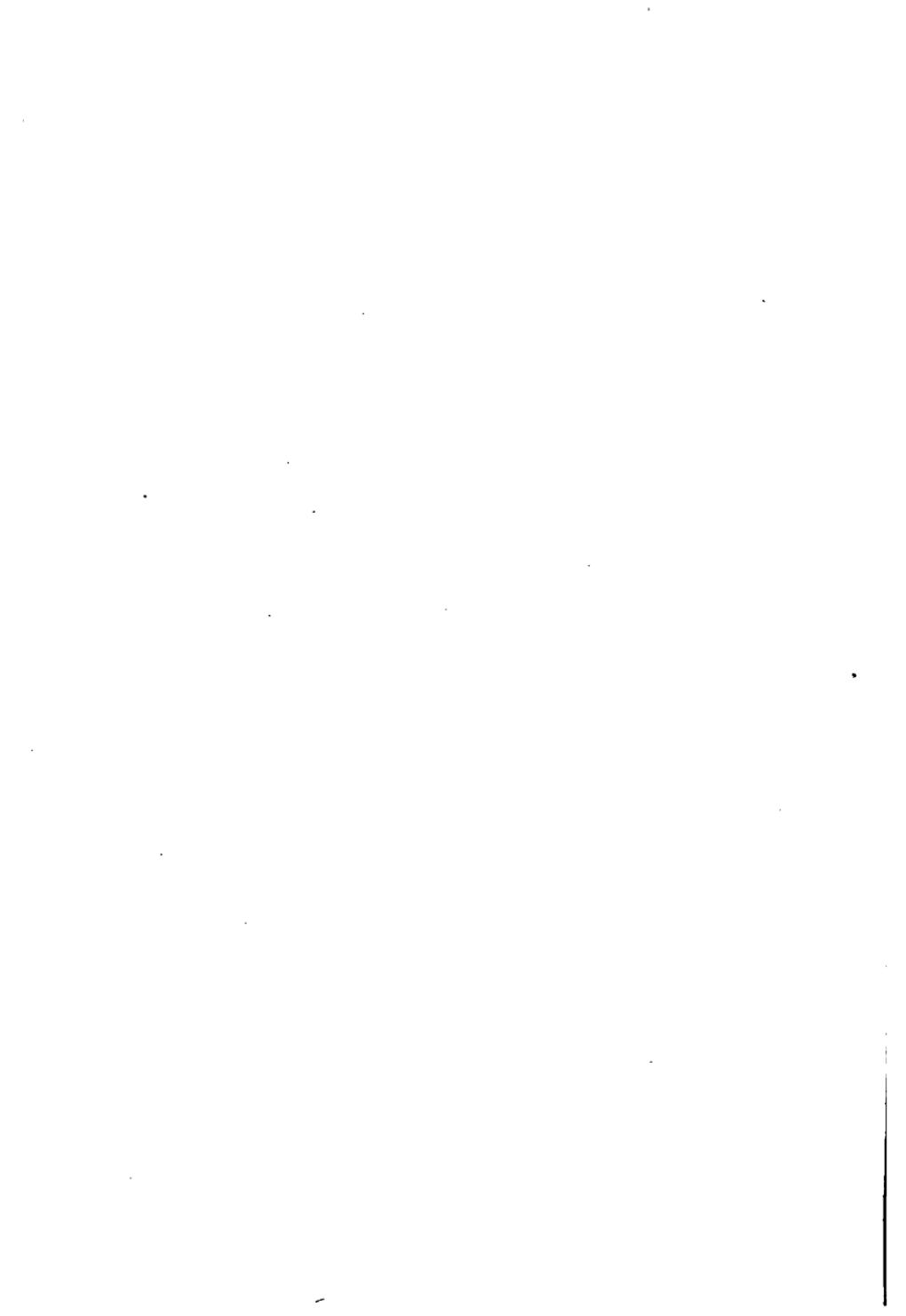








Over the Drawing Board



Over the Drawing Board

A Draftsmen's Hand Book

by

BEN J. LUBSCHEZ

Fellow of the American Institute of Architects.
Author of "Perspective, an Elementary
Text Book."

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PREFACE

It was a quite common custom in the West during the early nineties for draftsmen to visit each other's boards and discuss their work and methods, or during the noon hour while eating lunch at the board or at the big detail table which was used only occasionally, to talk over past experiences in other offices and tell about little shortcuts and methods of other draftsmen—that is how I first heard and learned of the work of Harvey Ellis and D. A. Gregg. Again perhaps one of the older men was working on a particularly interesting drawing and the student and some of the younger men were allowed to look on for a few minutes and even to ask a question or two. All these things did not help the orderly working of the drafting room but they contributed mightily to the education of the draftsman, particularly if he were anxious to learn. I can recall no experiences of my "cub" days with greater pleasure.

Through years of rubbing elbows with draftsmen all over the country I have been enabled to learn a host of better ways of doing both common-

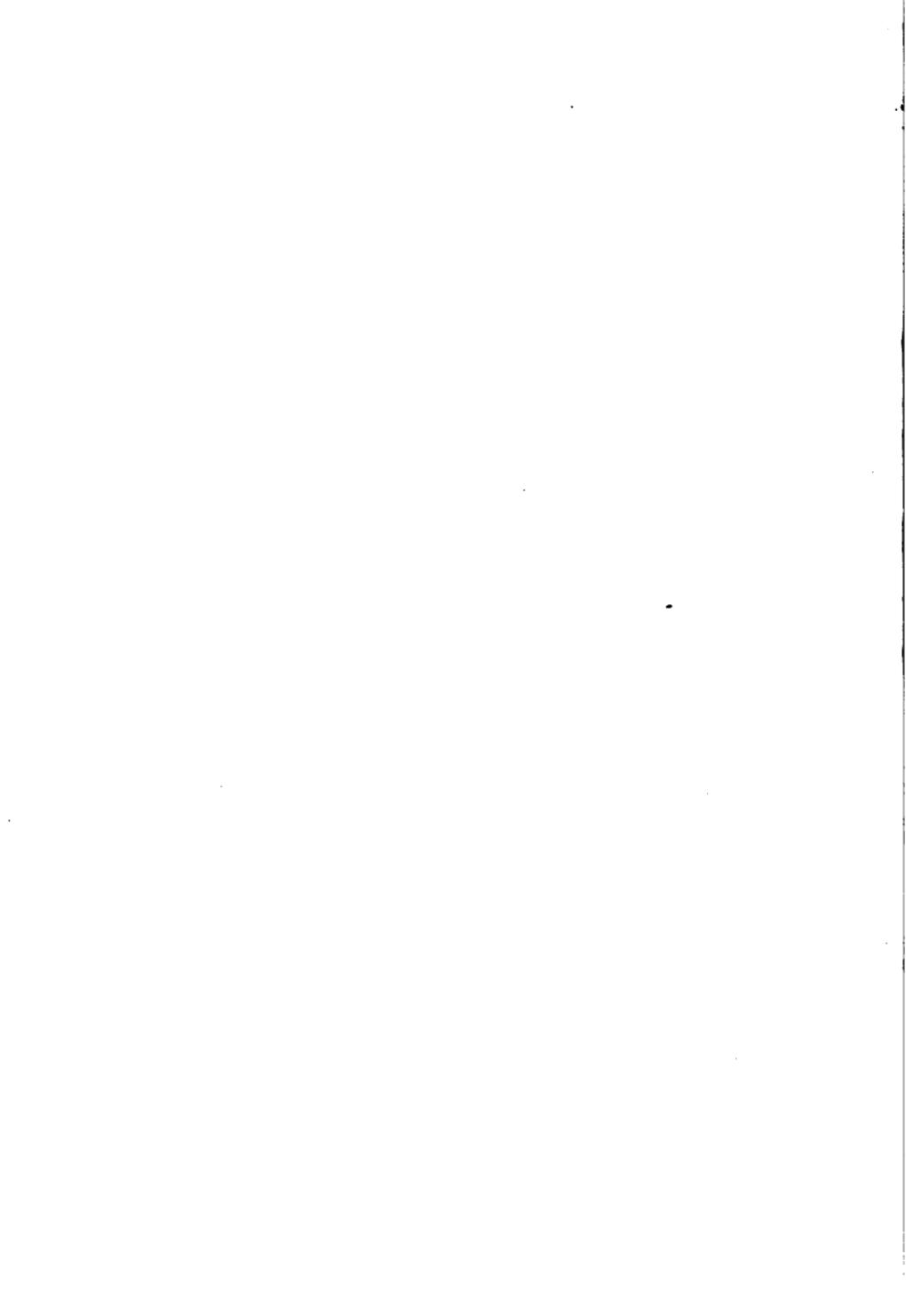
place and unusual things. Many of these methods will be new to readers while others will as surely be old, and this book, a gathering of things learned from experience and chats "Over the Drawing Board," is sent forth with the hope that its contents will help others as it has helped the author and that it will serve as a good friend in the pocket or on the board.

B. J. L.

New York
December 13th, 1917

CONTENTS

	PAGE
I. Introductory	I
II. Drafting Room, Equipment, Instruments....	3
III. Mounting of Paper and Drawings.....	13
IV. Tracing Paper and Tracing Cloth.....	29
V. Geometrical Short-Cuts	39
VI. Lettering, Titling, Numbering	54
VII. Working Drawings, Indication, Lines.....	63
VIII. Sketches, Exhibition Drawings, Water Colors, Perspective	80
IX. Filing of Drawings and Plates.....	101
X. Photography	108
XI. The Reproductive Processes, Photo- Engraving, Etching, Wood Engraving, Lithography	114
Index	123



LIST OF ILLUSTRATIONS

FIGURE	PAGE
1. Mitered Borders and Mats	27
2. Mr. Platt's Rendering in Charcoal, Quarter Size	after 32
3. Mr. Platt's Rendering in Charcoal, Full Size	before 33
4. Dividing a Line into Equal Parts.....	40
5. Elliptical Arch by Approximation.....	43
6. Rake Ellipse by Approximation.....	45
7. Egg-Oval by Approximation	47
8. Drawing True Ellipse by String Method.....	48
9. Drawing True Ellipse by Straight-Edge Method	49
10. Method of Drawing Plan of Scroll Newel....	53
11. Method of Drawing Plan of Scroll Newel....	53
12. Method of Drawing Plan of Scroll Newel....	53
13. Guide Lines in Lettering	55
14. A Method of Free-Hand Lettering.....	56
15. Suggestion for Form of Title	59
16. Indication at Various Scales.....	66
17. Chart of Suggested Indication of Materials....	75
18. Chart for Experiments in Color.....	84
19. Diagonals and Perspective Centers.....	92
20. Even Divisions in Perspective.....	93

FIGURE	PAGE
21. Odd Divisions in Perspective.....	93
22. Diagonals for Measuring in Perspective.....	94
23. Laying Out a Free-Hand Perspective.....	96
24. Inverting the Process of Perspective.....	98
25. Pictorial Photography, Washington Square, New York	facing 108
26. Pictorial Photography, The Capitol, Wash- ington	facing 109
27. "Painting with Light," Lower Broadway, New York	facing 112
28. Detail Enlargement of Part of Small Neg- ative	facing 113
29. Half-Tone Reproduction of Etching....	facing 116
30. Line-Cut Reproduction of Wood-Engrav- ing	facing 118
31. Half-Tone Reproduction of Lithograph..	facing 120

UNIV. OF CALIFORNIA.

I. INTRODUCTORY

The administration of an architect's or engineer's office may quite naturally be divided, broadly, into two parts, which may be called—rather inadequately it is feared—the business branch of the office and the drafting branch.

Under the business branch come all the business and contractual dealings of the office: interviews and agreements with clients; the framing of contracts; accounting; to some extent, supervision; the keeping of records; correspondence and its filing. Architects are usually accused of a lack of business efficiency, yet most of the larger architect's offices all over the country, have model business organizations.

The second branch has to do with planning, designing, and their study; preparation of the documents with the guidance of which structures are built, or by means of which the architect's or engineer's ideas are presented to his client, and therefore has to do mostly with drawing, for it is mainly with drawing and by drawings that planning and design are studied, that the ideas of the designer are conveyed to the craftsman who works them out, that the dreams and thoughts

TO THE AMERICAN

OVER THE DRAWING BOARD

of the designer are brought before the client for his consideration and criticism.

Drawing is a language, the oldest one, the simplest one and the universal one, as may be seen by the Indian signs and the hieroglyphics of Egypt. To acquire its rudiments, is a comparatively easy task. Like every language, however, drawing has its idioms. As a master of any language is the master of its idioms, so the master draftsman is the master of the idioms of drawing, and it is hoped, in what follows, to present at least a few of these.

The two branches overlap somewhat, but as far as possible, these pages deal only with the second branch, drafting room practice and drawing.

II.

DRAFTING ROOM, EQUIPMENT, INSTRUMENTS

Instruments and Materials

Most books on drafting begin with a discussion of instruments and materials that the student should buy before he begins work—and the list is usually quite formidable!

Really excellent drawings have been made with a cheap pencil and inexpensive compass. The excellence of the drawing was not on account of the cheap tools, to be sure, it was rather in spite of them, but it only goes to show that a good workman does not "quarrel with his tools." It is pretty true that the clever draftsman is rarely as fussy about instruments, his paper or his media as the poor one, who usually devotes much time which might better be used for the strengthening of his abilities as draftsman, to puttering over his instruments.

Quality of Paper, Instruments, and other Media

Of course, it is not true that quality in the paper, instruments and other media is of no importance. It is of great importance, but the capable draftsman who knows how, will stamp the mark of his ability on the sketch he makes

OVER THE DRAWING BOARD

on a piece of strawboard with a lumber crayon while the poor bungling draftsman will make a weak smudge with the finest instruments on the best sheet of paper. To be sure, it is much more pleasant to work on good paper, with accurate instruments and reliable tools, and the beginner, particularly, should not handicap himself with poor material and untrustworthy tools for although the best tools and materials never in themselves made good drawings, he should have no opportunity to blame poor results on the quality of tools or paper, but rather on himself alone.

As we go along, tools and materials will be discussed in a broad way more to guide the draftsman's discrimination when he buys them, than to give him specific lists of things to buy. He should buy what he needs as he needs it and experience must guide him to a great extent. The draftsman should never forego an opportunity to learn from those around him, nearly every draftsman has some way of doing some little thing which is better than the customary way. Keep your eyes open and be watchful, "get acquainted with your neighbor, you might like him" and he may know more than you do!

Drafting Room

The arrangement of the drafting room, its lighting and ventilation have a profound influence

DRAFTING ROOM AND EQUIPMENT

on the health of the draftsman and consequently on the quality of his work. What is said below may be as appropriately applied to the conditions around the student's single drafting board in his own home as to the large room in the office of the architect or engineer who employs many men.

Ventilation in Drafting Room

The room should be well ventilated—many a headache caused by foul air has been mistaken for one caused by eyestrain, under the illusion that eye-strain is the most natural thing for a draftsman! The ventilation should be such as to avoid drafts and gusts of wind which blow papers around in an annoying way. Electric fans, although often a very necessary evil and excellent for many things such as quick drying of paper or ink lines, are a great nuisance in the drafting room, nevertheless. The patent sash ventilating devices are excellent. Many improvised ones are as good. A five or six inch board placed between jambs of the window and held in place on the sill by the bottom rail of the lower sash, separates the meeting-rails and gives efficient ventilation in winter time at practically no expense. To keep the head clear and the hand steady, there must be fresh air around the worker.

Light in Drafting Room

Too much light is as bad as too little. The

OVER THE DRAWING BOARD

light should be even and should always come from the left side. One should never work facing the source of light—it will speedily strain and weaken the eyes. There is always considerable light reflected from the drawing. If one faces the window, this reflected light will shine directly into the eyes, and also whenever one looks up, the glare of light is met. This is all very injurious. The source of light, as has been said, should always be at the left side—if the worker is left-handed, then the right side—so the working edges of instruments like the T-square and triangle will be properly lighted and the light will be kept out of the eyes; it should be on the work instead. The eyes should be shaded. There should be sufficient light but not too much and direct sunlight should be avoided. Looking up from the work occasionally is a good habit—it relieves the strain, and the readjustment of the eye-focus exercises the eye-muscles and prevents their stiffening.

Equipment of Drafting Room

The furniture in the drafting room should be simple and strong. Trestles and tables should be quite rigid—a shaky, wobbly drawing board is extremely annoying. Some provision, such as a case of drawers or a vertical filing case, should

DRAFTING ROOM AND EQUIPMENT

be made for keeping drawings—a rolled drawing is an obstinate abomination.

Full-size Scales in Drafting Room

Full-size scales, horizontal and vertical, marked off on the walls of the drafting room are very convenient to the draftsman for comparative study of dimensions on his drawings and to show the client actual dimensions of things.

Drawing Tables

The proper height of the drawing table depends entirely on the individual using it. 30 inches at front is a good average. The board should be of such height as to enable the draftsman to work on every part of it in comfort. The trestle or table might well be adjustable in height and the top should be so that it can be tilted at an angle of ten to thirty degrees with the horizontal, if necessary.

Drawing Boards

The size of the board for ordinary work is from 30" x 42" to 36" x 48", the latter preferred. It is well to use the board on a table somewhat longer than itself so as to leave a space at the right for reference drawings, instruments and so on. A regular trestle with a separate side table is also satisfactory. The board itself should be of white pine with cleats on bottom, and preferably unfinished, that is, free from shellac or varnish.

OVER THE DRAWING BOARD

The furnishing of the drafting room is a great deal a matter of personal preference—suffice it to say that in the ideal drafting room there should be a convenient, accessible place for everything used in the room and everything should be kept in its place.

Water in Drafting Room

Every drafting room should have running water, easily accessible.

Covers for Tables

There should be covers for the drafting tables, of water-proofed cloth if possible, but closely woven muslin or sheeting is excellent.

T-Squares

Perhaps the best T-squares are those with transparent edges and split heads — one side rigidly fastened, the other with a swivel so as to be adjustable. T-squares should never be left on the board over night—this causes them to warp and become crooked — they should be hung up instead. They should never be used for trimming paper or as guides in cutting—a cheap straight edge will do as well and will save the square from being cut or nicked.

Triangles

Triangles of transparent composition are to be preferred, for besides the great convenience of

DRAFTING ROOM AND EQUIPMENT

their transparency, they retain their edges and accuracy much longer than wooden ones.

Scales

Scales should have white edges. Flat scales are preferable to triangular ones and it is better to have several scales for the different graduations than to try to get everything on one scale. To have to turn and turn the scale around every time it is picked up to find the correct graduation is very annoying and besides furnishes a chance for serious error.

Compasses and Dividers

Compasses and dividers should be strong and accurate. Instrument catalogs have valuable data on the merits of the various forms of instruments and their construction. When the draftsman knows just what he wants to do with any particular instrument, he can easily find several forms for the purpose described explicitly in the catalog, and can judge of the merits for himself.

Ruling Pens

The ruling pen is perhaps the most important and most used instrument. It should be of the very best quality even at the sacrifice of quality in other instruments. It should be of the type which may be easily cleaned carefully before putting away or laying down for any length of time.

OVER THE DRAWING BOARD

It needs sharpening occasionally as the nibs wear down with use.

Sharpening of Ruling Pens

Every draftsman should learn how to sharpen his own pen, so that he may always keep it in good condition. The best way to learn the sharpening process is to watch an expert do it once or twice, but a few directions and practice on an old pen may help. First adjust the nibs so they just touch. Then on a fine carborundum or oil stone, run the pen back and forth with a side-ways rocking motion so as to shape the nibs to a rather pointed oval. They will now be very dull; separate the nibs and sharpen each one separately by rubbing the outside with a rocking motion on the stone so that the oval point is just sharp and the bright flat spots disappear. The pen should not be sharp enough to cut the paper and if it becomes too sharp it may be run back and forth on rough drawing paper as in first shaping the points, until it is slightly dulled.

Pencils

The choice of pens, pencils, ink and paper for the different kinds of work is discussed under the various processes described. One word about pencils, ink and erasers, however: the draftsman with a good touch, the one who puts real quality

DRAFTING ROOM AND EQUIPMENT

and feeling into his work, has very little use or tolerance for the hard pencil. Of course, the hardness depends a great deal on the surface of the paper worked on but rarely if ever will anything harder than 3H be needed and for most work softer ones are to be preferred.

Watered or Diluted Ink

As to ink, we are apt to overlook the possibilities of watered ink, the ordinary Indian drawing ink thinned with water so that it just misses being opaque. It is more easily used, flowing better from the pen, erases easily, far more easily than the full black ink, and in combination with black ink doubles the possibilities of indication on line drawings. More of its advantages will be pointed out as we go along.

Watered ink doubles the possibility of making a blue-print legible—without it there is only the variation in thickness or weight of line, with it we have also the variation in tone or distinctness, doubling the latitude of expression of every kind of line.

Erasers

The less erasing of any kind there is done on a drawing, the better for the drawing, but erasing must sometimes be done. For pencil, charcoal or crayon, there are erasers varying from

OVER THE DRAWING BOARD

the very soft "kneaded rubber" and "Art Gum" to the hard rubber varieties. The kind to use depends on the character of the mark to be erased as well as on the character of the paper on which it is made. The draftsman should have both a soft and a hard eraser. For ink lines the so-called typewriter eraser (rubber charged with fine emery) is excellent. The erasing can be advantageously finished off or cleaned up with a hard pencil rubber. A sharp knife is also very useful. On tracing cloth, the new erasers made of spun glass threads are wonderfully efficient.

Erasing Shield

The erasing shield, a thin metal plate with various sizes of slots and openings, is an extremely useful tool. Its use will suggest itself after a brief acquaintance. Among draftsmen it is familiarly called the "slot-machine" and it often proves itself a friend indeed.

Light Rubbing

In erasing, light rubbing usually gives better results than hard rubbing. Ideal erasing consists in rubbing hard enough merely to remove the mark from the *surface* of the paper, which should be disturbed as little as possible.

III.

MOUNTING OF PAPER AND DRAWINGS

Stretch Mounting vs. Thumbtacks

When it is attempted to make a really good, clean-cut and accurate drawing on paper that is merely thumb-tacked to the board, the draftsman is immediately handicapped by many difficulties, the paper seems imbued with a lazy sort of life—it stretches, it shrinks, it crawls and it misbehaves generally. When it is attempted to make a tracing over such a drawing, the tracer is doubly handicapped and the results are apt to be doubly inaccurate. Thumb-tacks have their place, of course. Small drawings and rough drawings at large scale that require but a few hours to complete may well be made on paper that is merely tacked down. Tracing linen is usually tacked down because it cannot be mounted or stretched on the ordinary board successfully. It is often most convenient to tack paper tracings, but for a good working surface, for a surface on which is to be made an accurate drawing of considerable size and which will take considerable time to com-

OVER THE DRAWING BOARD

plete, the paper should be stretch-mounted or else it should be mounted solid on heavy card-board or wall board.

Stretch-Mounting, General

The general process of stretch-mounting paper on a drawing board consists of; first, moistening the paper so that it swells and expands; second, while the paper is in this condition, sticking the edges to the board with thick strong paste so that, third, on drying the shrinkage of the paper will stretch it taut and smooth. This is the general process, but the details are different for different kinds and qualities of paper. Thin transparent tracing paper must be handled quite differently from the heavier opaque drawing papers.

Stretch-Mounting, Heavy Paper

We shall begin with the opaque drawing papers. Cut to size the sheet to be mounted, making the edges straight and square. Now moisten the surface all over to the edges with a wet sponge and allow to soak for a minute or two until the paper is limp and flat. Moistening on both sides may be easily accomplished by laying the paper face down on the clean drawing board and moistening the back first, letting the water soak in for a minute or two, then turning the paper over and moistening the face side. Paste should be distri-

MOUNTING

buted rather thickly, about $\frac{3}{8}$ or $\frac{1}{2}$ inch wide from the edge all around on the back. Higgins' Drawing Board Paste is made especially for this purpose and is excellent. There are various ways of applying the paste on the edge and one's ingenuity should lead him to the best; the edge may be lifted and the paste applied to the back, or the whole sheet may be reversed for the application. The edges of the sheet should now be rubbed down on the board—a putty knife or wall-scraper is an excellent tool for this and it is also useful for cleaning the board later. When the edges are pasted down securely, the paper should be allowed to dry, when it will be found taut and smooth.

Stretch-Mounting, Very Heavy Paper

Different weight papers require more or less wetting and soaking—the thicker and denser the paper, the more thorough wetting is required. Small sheets of heavy Whatman or similar paper may well be soaked in a tray until limp, when the surplus water may be blotted off just before pasting. On very heavy, dense paper, it is well to punch, before mounting, a few pin-holes in each corner to allow the air underneath the paper to escape when the paper is flattening. Even 5-ply bristol board may be mounted if this precaution is taken.

OVER THE DRAWING BOARD

Stretch-Mounting, Very Thin Paper

Very thin papers like tracing paper or bond paper should be mounted dry and then moistened. These are usually mounted over other paper upon which has been made the drawing to be traced or which is merely used as a ground. The paste is applied thickly in a narrow band about $\frac{3}{8}$ " or $\frac{1}{2}$ " wide on the ground paper or on the board just outside of it. A piece of the paper to be mounted is cut about one inch larger than the paste line and rolled up. One end of this roll is then applied to the line of paste on the board and the paper is gradually unrolled with one hand while the two side edges are simultaneously pasted down with the other hand—always rubbing from center to edge—and finally the end is pasted. After setting a few minutes, the surface is moistened with a sponge, carefully, so as not to tear or injure the paper. On drying, the shrinkage will have drawn the paper taut with a delightful working surface. Thin soft drawing papers like charcoal paper may also be easily mounted in this way.

Solid Mounting of Paper

Many draftsmen prefer making sketches and rendered drawings on paper solidly mounted on

MOUNTING

card-board or wall-board. Many prefer making the outline drawing on ordinary weight paper then solidly mounting this outline drawing on card-board or wall-board for the rendering. This requires no especial instructions — it is merely pasting down one piece of paper on another. A rubber photographic print-roller is very convenient to bring the papers in contact, the roller should be used from the center of the sheet outward toward the edges and the edges and corners lifted if necessary to prevent buckling and creasing, until the rolling is complete. The drier and stiffer the paste used, the less curling and warping of mount will result. Pasting paper (not necessarily drawing paper) on the back of the mount will also keep the mount straight.

Cleaning of Boards on Removal of Mounted Paper

The most serious objection to the stretching of paper for drawing purposes is one born of laziness—"it is too much trouble." The cleaning up of boards after removal of the drawing is a messy operation if not done in the right way and has contributed much to the objection. The drawing is removed by cutting with a knife just within the pasted edge. All of the pasted edge that can be is then torn away. The edges are then wet thoroughly with a sponge and allowed to soak a

OVER THE DRAWING BOARD

few minutes, when the paper may be easily scraped away with a putty knife or wall-scraper. The use of the putty knife or scraper will save about fifteen minutes soaking and considerable muss. The board should now be wiped off and allowed to dry. Several boards may be cleaned in little more time than one by allowing one to soak while scraping the other and so on.

Trimming and Mounting Drawings

After having made a drawing to show the client, or for public exhibition, it is necessary to trim it and mount it properly. This is quite important and will either enhance or mar the effect. The drawing may be framed under glass or without, or it may be left entirely unframed. It is always advantageous to mount even small sketches on some support to facilitate their handling. These need not be permanently mounted, however, as will be shown later.

Sticking Down Corners

Dividing drawings into classes as to the paper on which they are made, we shall consider, first the mounting of those made on paper having considerable body and then those made on thin or tracing papers. The simplest way to mount a drawing, if it is not too large, is to stick it down at its corners and a point or two between on each

M O U N T I N G

edge, on an ordinary piece of card-board or other support of suitable color and texture.

All-Over Mounting

The next simplest method is all-over mounting on a similar support. The drawing is trimmed properly and laid on the mount in proper position and its corners lightly marked on the mount. The drawing is then laid face down on a clean piece of paper or, better yet, a clean sheet of glass. Rather thick paste is now applied sparingly and evenly to the back of the drawing—many use wall-paper paste on account of its cheapness—and the sheet is lifted carefully and placed on the mount in proper position according to the corner marks made. It should now be covered with a clean piece of paper and rubbed into contact with the hands, always beginning in the middle and rubbing toward the edges, the better way, however, is to use a photographic print roller, rolling from the middle toward the edges. If too much paste has been used it will ooze out from under the edges of the drawing but even if the paste has been applied sparingly it may ooze out a little. The surplus paste may be removed with a damp sponge.

Curling of Mount, Prevention

Unless the mount is a very heavy one, and the paste used quite stiff, it will curl on drying. This

OVER THE DRAWING BOARD

curling may be counteracted very simply. It is necessary only to mount a piece of paper the same size as the drawing and approximately the same weight, on the back of the mount. The curling tendency will thus be balanced and the whole will dry quite flat.

Mounting on Stretchers

The objection to all-over mounting is that the drawing cannot be removed when necessary — that it must always be kept with the mount, which may be rather bulky, especially for large drawings. There are two ways of overcoming this objection. One is to mount the drawing on a stretcher. A stretcher is simply a light wooden frame with muslin or sheeting stretched and tacked over the edges. The frame may be made of plain strips or may be put together of dovetailed and cleated strips made for the purpose and which may be had in various lengths. After the muslin is stretched and tacked on the frame the drawing may be pasted just as it was before. It must be laid face down on a clean surface, however, and rubbed into contact from the back. If a mat or border is desired, the stretcher must be larger than the drawing and then paper of the desired color may be pasted around to form the mat, this paper lapping over the edges of the drawing a little. Another way is to mount the

MOUNTING

colored paper—ingrain or oatmeal wall-paper is excellent—all over the stretcher and when dry, to mount the trimmed drawing on this. Either way allows the removal of the drawing, now mounted on muslin, at any time by simply removing the tacks on the edges of the frame.

Mounting on Compo-Board

Beside the stretcher method, drawings may be mounted on heavy mat-board, wall board or best of all, "compo-board" so as to be easily removable. This is simply done by first stretch-mounting a piece of paper on the compo-board just as we would on the drawing board, pasting only the edges. This paper should be strong but not too thick—heavy tracing paper is excellent. When this stretched paper is dry the drawing may be mounted solidly on it, only keeping back from the pasted edges. Borders or mats may now be improvised as was done for the stretcher and as will be more explicitly explained later. If at any time it is desired to remove the drawing it is only necessary to cut through just within the pasted edges of the original stretched paper and the whole will come off. The mounting board may be used many times in this way. These methods are especially valuable in school work or when only temporary mounting for exhibition or judgment is needed.

OVER THE DRAWING BOARD

Mounting Drawings Made on Tracing Paper

Tracing paper may be mounted by pasting the corners and points on the edges as were heavier drawings, but being rather flimsy it is thus subject to tearing and other damage. Tracing-paper may be mounted solidly on any paper or board that may be desirable. If the paper on which it is to be mounted is rather light in weight—that is, not card-board—it should be stretched first for best results.

To one who has never tried it in the right way, the attempt to paste down solidly a piece of tracing paper, which even when dry is rather fragile, seems a hopeless task. First, we take a sheet of glass, somewhat larger than the tracing we wish to mount, if this is more than eighteen inches, we should have plate glass. Place the tracing face down on this sheet of glass. Reduce some clean white paste with water to the consistency of cream. Apply the paste with a good brush—a small varnish brush is excellent—to the back of the drawing and brush back and forth until the paste is thinly and evenly distributed and the paper lies quite flat. With a damp sponge now wipe off the surplus paste on the glass beyond the edges of the drawing. Have the mount, whether it is paper, stretched or unstretched,

MOUNTING

card-board or wall-board, ready on a table. Now lift the sheet of glass with the drawing on it—enough paste will have worked just under the edges to make the drawing adhere temporarily to the glass—and place, drawing first, in correct position on the mount. Press the glass down so as to bring the drawing into more or less contact. The glass may now be lifted off, leaving the drawing on the mount. It should be rolled into perfect contact with a photographic print roller as directed before for other mounting, rolling from the center to the edges, using clean paper or blotting paper under the roller. Any surplus paste at the edges may be removed with a damp sponge.

Advantages of Mounted Tracings

Tracings mounted in this way may be handled and exhibited with the same ease and with the same resistance to wear and tear as drawings made on heavy papers, but give the draftsman all the advantage of having been made on tracing paper.

Demounting Tracings

Tracings mounted solidly are usually considered permanently so, but with patience and care they may be removed from the mounts, although it is rather a delicate undertaking. The tracing should

OVER THE DRAWING BOARD

be moistened with a damp sponge until the tracing paper is quite moist, then by beginning at one corner and using great care it may be pulled off the mount. It is not advisable to try this for the first time if the tracing is valuable and must be preserved. If only the re-use of the mount is desired, tearing the tracing is of no moment.

Stretch-Mounting Tracings

The method of stretch-mounting tracing paper for drawing purposes has already been described. In a similar way a tracing may be mounted for exhibition. The properly trimmed tracing is laid on the mount and the edges are marked. A narrow band of paste is now applied just within the line on the mount marking the edges of the tracing and the edges of this are now rubbed down. If the paste is applied one edge at the time and the rubbing done from center of sheet toward edge, there will be less liability to form wrinkles and creases. After the edges are all pasted, the surface of the tracing should be dampened, if possible, with a sponge or wet blotter and on drying it will be found stretched smooth and tight. It will look quite presentable without dampening and stretching, however, if this is impractical.

Ordinary paper drawings may be mounted in the same way if the paper is not too heavy. They

MOUNTING

may be dampened on the back before pasting if it is dangerous to wet the face.

Modification by Color of Mount

The appearance of a drawing on tracing paper may be changed considerably by the color of the surface upon which it is mounted. It may be warmed considerably by mounting on buff or even yellow paper. It may be subdued by mounting on gray paper. Experiments in this direction are well worth while.

Tinted Glass

Some interesting results can be had by framing drawings under tinted glass.

Borders and Mats

It is often necessary to put a border or mat on a drawing. The simplest way to do this is to take a piece of paper or mat board the outside size necessary and cut an opening in it the size of the picture, and pasting this down in the proper place. Draw the outline of the opening necessary and whenever possible cut through the mat in one cutting. A well sharpened, sturdy knife is best for the purpose. There are excellent special mat-cutting knives on the market.

It is often impractical to use the cut out mat on a drawing. Mat board is limited in size and

OVER THE DRAWING BOARD

therefore sometimes it is not large enough. Again it may not be possible to use it on account of the character of the mount used and it may be that thin paper of more desirable color or texture is wanted.

Mitered Borders and Mats

It is quite easy to apply a mitered border or mat made of strips of paper. Cut four strips of paper the length of the edges of the mount and about two inches wider than the desired mat or border. Apply paste on the back of one of these strips and stick down meeting the border line of the drawing with one edge and folding the other edge over the edge of the mount and pasting it to the back. Now cover the corner of this strip a little more than its own width from the corner of the mount with any sort of paper, a piece of newspaper will do, and quickly paste the adjoining strip of border on as before. With a sharp knife now cut through from inside corner of border strips to outside corner of mount, cutting clear through to the mount. Now by lifting the ends of the two border strips and removing the newspaper cover and the superfluous triangles of paper and again pasting down the ends, we have a perfect, almost invisible mitering of the strips. The newspaper was used merely to avoid soiling the first strip with the pasted end of the second.

MOUNTING

Figure 1 will make the stages of this process clearer, perhaps.

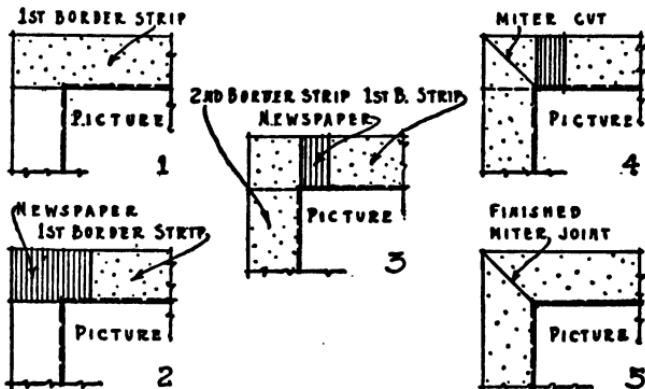


Figure 1
Mitered Borders and Mats

The other corners should be done the same way. All this should be done quickly so that the paste does not dry at any place where the paper has to be lifted in order to remove the surplus. To expedite matters, everything should be gotten in readiness before beginning the application of any of the strips.

Applied Bands

It is often advantageous to separate the drawing from the mount by a band of gold or silver or black. This may be done by using sheet-paper

OVER THE DRAWING BOARD

cut into strips or by using narrow passe-partout paper and pasting it on. Ragged edges on the drawing may be covered up and the whole thing given a finished appearance by this kind of an applied band. The gold band is especially efficacious, for gold harmonizes with all colors.

IV.

TRACING PAPER AND TRACING CLOTH

Tracing Paper, General Uses

No one thing that the draftsman employs is so widely useful as tracing paper. Upon it may be made the whole gamut of drawing from the merest "short-hand" sketch to the most finished rendering and working drawing. As a help in drafting, such as transferring, "frothing" and so on, its uses are well nigh unlimited. One can almost judge the ability and efficiency of a draftsman by the methods and extent of his using tracing paper.

Tracing Paper in Studying

For studying or developing a design or plan or detail, nothing is as convenient or useful as thin transparent paper with a good tooth or surface for pencil. The draftsman can use layer upon layer of the paper, each successive layer showing a new development, and at any stage of the work he can lay out before him all the progressive studies. He may discover that at a certain point he wandered off on a tangent and that his sixteenth sketch is not as promising as his ninth, say.

OVER THE DRAWING BOARD

All he has to do is to begin again at his ninth sketch and try a new path of development. There is a wonderful fascination about this. There is a wonderful interest in a group of such sketches — they present an intensely human and graphic history of whatever one was studying. Now for the mechanical details—the “modus operandi.”

Tracing Paper, How to Use in Studying

To begin with, a substantial piece of paper should be stretched on the board and on this paper should be outlined in strong lines the fixed general dimensions, axes if any, and all important and mandatory lines of what is to be drawn or designed. Now on tracing paper over this skeleton one proceeds — mostly free hand — with a soft pencil, crayon or charcoal, to sketch and study to his heart's content. The tracing paper may be tacked over the stretched paper, it may be pasted at the corners or it may be stretch-mounted.

Short Rolls of Tracing Paper

The draftsmen should have at hand a generous supply of pieces of paper cut to size, or what is still more convenient, a narrow roll of paper sawed off from the regular roll. A 36" or 40" roll sawed into three equal lengths is very convenient or a 36" roll cut into 10", 12" and 14" lengths is useful. From these, pieces of the right length may be easily torn by holding a

TRACING PAPER AND CLOTH

straight-edge, T-square or triangle, at the right point and tearing away the paper.

Rendering on Tracing Paper

Sketches on tracing paper may be rendered in soft pencil or pen and ink; if the paper is stretched, they may be tinted in water color. Beautifully soft sketches may be made by rendering in soft pencil and then tinting rather broadly on the back of the tracing paper with colored crayons. By laying the drawing face down on clean paper the outline or pencil rendering is strongly visible as a guide to the tinting. Further interesting effects may be had by mounting these finished tracing paper sketches on tinted papers.

Perspectives Rendered on Tracing Paper

In making rendered perspectives it is of great advantage to do the rendering on tracing paper. The outline perspective may be made on any good paper and as completely as wanted. Tracing paper may now be stretched or tacked over this outline and the rendering made as freely as the draftsman desires with the assurance that no fragments of outline or working lines will disturb his finished drawing and that no cleaning will be necessary.

Mr. Platt's Charcoal Drawings

Mr. Charles A. Platt's rendered drawings in

OVER THE DRAWING BOARD

charcoal on Manilla tracing paper are in a class by themselves. They are made simply and quickly by working over an outline drawing on detail paper. The shades and shadows are then put in with charcoal on the manilla tracing paper stretched over the outline drawing. The edges are all drawn mechanically with aid of T-square and triangle. Stumps and chamois are used for blending the charcoal. The results are wonderfully realistic, almost photographic drawings that are nearly as valuable as models in studying details. Figure 2 shows a part of one of these drawings reproduced at one-fourth the scale of the original, while Figure 3 shows a detail of the same drawing reproduced full size.

"Squared" or Cross-Section Paper in Sketching or Measured Drawing

In sketching and preliminary studying, "squared" or cross-section paper may be used to great advantage. This paper is faintly ruled in squares of eighths or tenths of an inch. These squares may be assumed to represent any dimension and the free-hand sketch so made approximately to scale. The same result may be attained by using thin tracing paper over the "squared" paper.

For free-hand drawing preliminary to measured drawings of existing work, "squared" paper is

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THE VILLAGE
ARCHITECTURE



Figure 2
Mr. Platt's Rendering in Charcoal,
Quarter Size Reproduction

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CALIFORNIA

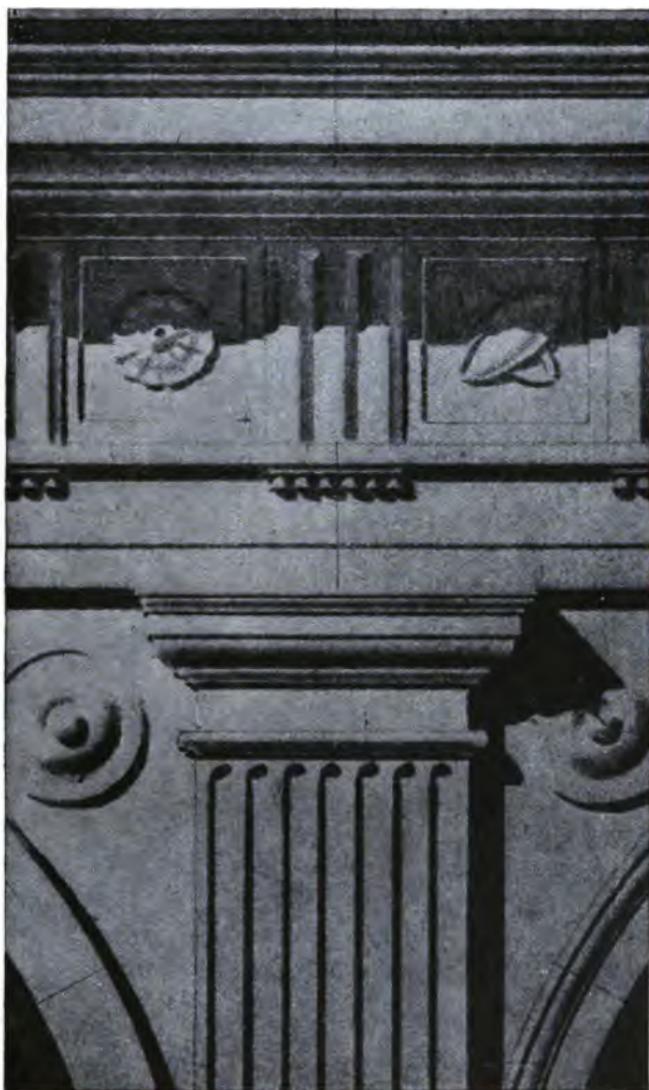


Figure 3
Mr. Platt's Rendering in Charcoal,
Full Size Reproduction

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TRACING PAPER AND CLOTH

very useful as it enables the draftsman to make his free-hand sketch approximately to scale and in proper proportion both easily and quickly. The ruled lines also serve as guides for the drawn ones.

"Squaring" in Copying

In copying or reproducing a drawing at different scale, "squaring" is a useful device. The drawing to be reproduced is either ruled into small squares or covered with a piece of transparent tracing cloth so ruled. The paper on which the drawing is to be reproduced is now ruled lightly into squares bearing the same ratio to the squares on the original as the scale of the reproduction bears to the scale of the original. By noting the intersections of the lines of the original drawing with the ruled lines on it and properly placing these intersections on the reproduction, it may be easily and accurately made to any scale. This is most useful in pictorial drawing and the drawing of ornament.

Tracing Paper vs. Cloth

Tracing paper plays or may play a very important part in the preparation of working drawings as we shall see later. Many draftsmen especially the older ones, do not begin to realize its many possibilities. Although it has not the strength or wearing and handling possibilities of tracing linen or cloth nor the resistance to erasure,

OVER THE DRAWING BOARD

it presents a much pleasanter surface on which to work, behaves much better on the board, it may be easily stretched and mounted and is withal much cheaper, ranging from $1/10$ to $1/2$ the cost of the cloth.

Transferring with Tracing Paper

Tracing paper is very useful as an auxiliary to drawing on other paper — in transferring or “frothing.” By its use the whole or any part of a drawing may be reproduced, without actual redrawing, on the same or any other sheet of paper. A drawing may be carefully studied on tracing paper and the final result transferred to a clean sheet of paper for inking-in or rendering without actual redrawing. For small details such as the profile of a moulding, the transferring process is the more convenient. The outline is simply traced with a soft pencil on a piece of thin tracing paper. This traced outline is then gone over with a soft pencil on the back of the tracing paper (if the outline is symmetrical this second tracing is unnecessary). By placing this tracing in the proper position on the drawing paper and going over the outline with a pencil, the design will be found distinctly transferred to the paper.

“Frothing” with Tracing Paper

More elaborate and larger drawings are more

TRACING PAPER AND CLOTH

easily transferred by the "frothing" process. We shall assume that we have a drawing on tracing paper which we wish to transfer to water-color paper—if it isn't on tracing paper we can easily make such a tracing. The tracing should be with rather strong lines and made with soft pencil. If the drawing is symmetrical this is all that is necessary, if not symmetrical then we must make a reversed tracing of it on the back of the original tracing or on another sheet. The latter tracing should then be put in the proper place on the blank sheet of paper, pencil lines down. The tracing may be held in position by thumb-tacks or, if the tack holes are objectionable, by slight touches of paste in the corners, the paste being easily removed later with a damp sponge. Over this tracing must be laid a clean sheet of tracing paper or better yet, tracing linen, and the whole rubbed, using considerable pressure, with some smooth rounded object like a round edged glass or marble paper weight, the rounded handle of a pocket knife or some similar object. After the whole has been gone over carefully and the tracing removed, the drawing will be found distinctly transferred to the paper and may now be inked in or pencilled in. This process is not nearly as formidable as it sounds, is a great time saver and really very convenient and useful.

OVER THE DRAWING BOARD

Tracing Linen or Cloth

Tracing linen or cloth is exceedingly useful material to the draftsman and it is perhaps ungrateful to say anything disparaging about it though it has many peculiarities that give its users constant grief. Its surface is rather difficult to work on, it rebels violently at moisture and even a damp atmosphere will cause it to cut all sorts of capers. It is very strong however, quite transparent, stands much erasure, and can be cleaned easily with benzine or gasoline.

Function of the Tracing

For the preparation of the transparency or tracing from which blue prints are to be made, tracing cloth is still the most popular and most widely used material. Tracing paper is supplanting it however and will probably do so more and more as the years go by. In the old days before the blue printing process was commercialized, the original drawings on paper were carefully inked in and finished on paper for the office set and one or more sets were then made on tracing cloth to be used on the work. Then the tracings were in themselves the end, now tracings are merely the means to the end, the blue print. This has greatly changed the process of draftsmanship and has lessened the necessity and desirability of using cloth.

TRACING PAPER AND CLOTH

Handling of Tracing Cloth

There are a few things to know about working on tracing cloth which make its use much pleasanter and which make the work much more efficient. A piece of tracing cloth should be stretched as firmly as it is possible to do so with thumb-tacks. One corner should first be tacked down, stretching the edges with the palm of the hand towards the next tack to be put in. Folding the corners about $\frac{1}{2}$ " prevents tearing of the cloth at the tack hole. Long edges should have one or more intermediate tacks. In damp or humid weather it is well to tack down the cloth, stretching it as tightly as possible, and leave it for an hour or more without working on it. It will then be found considerably expanded and buckled up. If it is now stretched out and retacked it will stay in place much better.

Powdering Surface of Cloth

The architect usually uses the dull side of the cloth and it is much to be preferred for it takes pencil well and erasures on it do not remove the glazing varnish. This surface, however, as it comes from the factory seems slightly greasy and does not take ink well. It should be rubbed lightly with precipitated chalk, flour of pumice or the prepared powder sold for the purpose, the latter being preferable. The surface thus rubbed will take ink perfectly.

OVER THE DRAWING BOARD

Tacking Tracings to be Left Over Night

On drawings which take considerable time to trace and where the uncompleted tracing must be left on the board for any length of time, as over night, if the tracing is left fastened down at the corners, the next morning is apt to find it all buckled up. It will be well nigh impossible to register the tracing accurately over the drawing. Especially will this be true if the weather turns damp in the interval. All this may be easily avoided by simply putting a thumb-tack in the center of each edge of the cloth, then removing all other thumb-tacks. The tracing will be found to have held its place perfectly in register and no buckling will be in evidence. The corner tacks may be replaced and the work continued. In fact, it is better to work on tracing cloth with tacks in the centers of the edges only if possible, but for large sheets this is not convenient.

This peculiarity of tracing cloth is due to its weave. When the tacks are in the corners there is no resistance to pulling, the little squares of the mesh rack in any direction upon expansion of the cloth by the absorption of dampness. When the tacks are in the center of the edges, however, pull and movement are resisted by the threads themselves.

V.

GEOMETRICAL SHORT-CUTS

Value of Geometry

Any draftsman who is not familiar with Plane and Descriptive Geometry is seriously handicapped in the making of mechanical drawings. The fact is that most draftsmen are familiar with these subjects to some extent and do not know it simply because they have not studied them in the abstract. As a matter of fact, all problems in drawing involving the construction of angles and curves and projection,—and nearly all do—and all the problems of perspective, shades and shadows and stereotomy are based on Plane and Descriptive Geometry. If the draftsman is not familiar with these subjects and has a liking for mathematics, he can acquire them by home study, and the time will be well spent. To the student of Geometry many short-cuts in laying out his drawing will occur.

Dividing a Line into Equal Parts

Any line may be divided into any number of equal parts with a scale or rule quickly and ac-

OVER THE DRAWING BOARD

curately. (Figure 4). In Figure 4, let A-B be the line which it is desired to divide in, say, seven equal parts. At B draw a line B-C with the triangle or T-square, as necessary, to make an angle with A-B. With the zero point of any convenient scale at A, swing the scale until the proper division point, in this case the seventh,

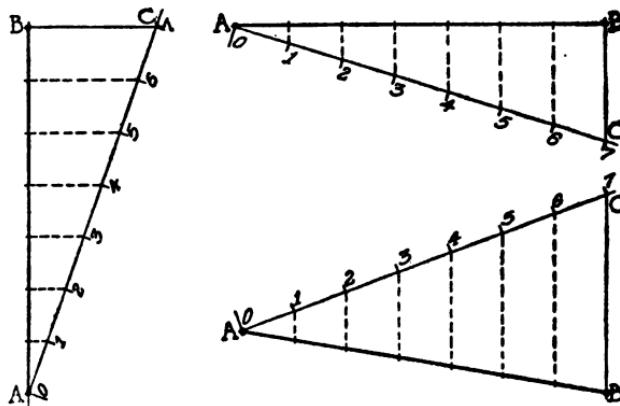


Figure 4
Dividing a Line into Equal Parts

(any multiple of the seventh would do as well, of course) is on the line B-C, mark the division points off on the paper and through these points draw lines with the triangle or T-square parallel to B-C. These parallel lines will intersect A-B at equal distances and in number as laid off by scale.

G E O M E T R I C A L S H O R T - C U T S

Laying-Off Equal Distances

This method is extremely useful in laying off equal distances like stair treads for example, which should not be laid off successively by scaling each one. Besides being laborious, this is very inaccurate. The total distance occupied by the equal divisions should be laid off and then divided into the required number of equal parts. If 10 treads of 11" each are to be drawn, the distance, 110 inches, is to be laid off and then divided into ten equal parts.

30°-60°, 45° and Adjustable Triangles

It will pay the draftsman to experiment with his 30°-60° triangles in the drawing of equilateral triangles, hexagons and so on. The combined use of the 30°-60° and 45° triangles will give many useful angles. There is also an adjustable triangle on the market which is very useful. Its right angle is rigid but the sloping edge is adjustable to any angle. Being reversible the use of this triangle in drawing roof slopes and other such lines is practically unlimited. It is also very advantageous to use the 45° triangle with its hypotenuse next the T-square. This gives a 45° line, sloping either way and saves much reversing of the instrument.

Ellipse and Oval

The ellipse and the egg-oval are constantly

OVER THE DRAWING BOARD

recurring curves, especially in architectural drawings, yet few draftsmen know how to draw either one correctly, or approximately with the compasses. Both the ellipse and the egg-oval may be closely approximated with a pleasing curve drawn with the compasses and although in laying out the work actual size the curves should be drawn with mathematical exactness, the approximate curve suffices very well on scale drawings and is the most practical to use on these.

Tangency of Arcs

If a law of the tangency of circles with each other and with straight lines is remembered almost any curve may be approximated by combining tangent arcs. If two circular arcs are tangent, the point of tangency and the centers of both arcs must lie on the same straight line and if an arc of a circle is tangent to a straight line, the point of tangency and the center of the arc must lie in a line perpendicular to the original straight line at the point of tangency. Bearing these conditions in mind arcs may be combined at will to approximate any curve.

Figures 5, 6 and 7 give methods of drawing approximations of ellipses and ovals with the compass, using three or more centers and combining the arcs of curves.

G E O M E T R I C A L S H O R T - C U T S

Elliptical Arch by Approximation

In Fig. 5 is given a very useful method of approximating an elliptical arch or semi-ellipse (of course the whole ellipse may be just as readily drawn). This method gives a pleasing curve and a very close approximation of a true ellipse.

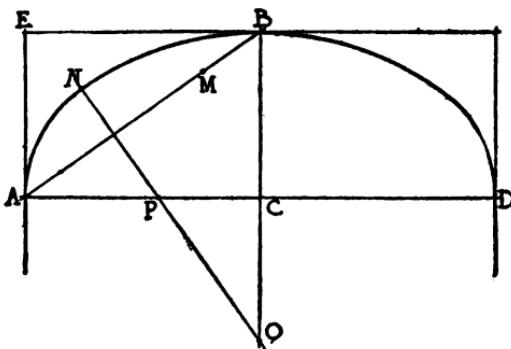


Figure 5
Elliptical Arch by Approximation

In Fig. 5, AC is half the major diameter and BC half the minor diameter of the arch. Draw the line AB. Lay off BM from B equal to AC less CB. NO bisects AM and is drawn perpendicular to it and gives P, the center of the arc AN, at its intersection with AC, and O, the center of the arc NB—, at its intersection with BC continued.

OVER THE DRAWING BOARD

Draw the arc AN with P as center and PA as radius and the arc NB with O as center and ON as radius.

Proof

To show that OB equals ON requires too long a proof and must here be taken for granted but it is easy to show that the laws of tangency are obeyed. The arc AN is tangent to EA at A because A, the point of tangency and P, the center are in AP, perpendicular to EA at A. The arcs AN and NB are tangent at N because N, the point of tangency, P, the center of AN, and O, the center of NB, are in the same straight line. NB is tangent to EB at B because B, the point of tangency and O the center of the arc are in BO perpendicular to EB at B.

Rake Ellipse by Approximation

In Fig. 6 an approximate elliptical arch is drawn on the rake, as it might occur under a flight of stairs. The rake line ACD is the rake major diameter of the curve and the vertical line BC half the minor diameter. BC is in the center between EA and E'D.

We should now sketch free hand, a curve tangent to EA at A, to EE' at B and to E'D at D.

Now draw line AP perpendicular to EA at A and on this line locate, by trial, point P which

G E O M E T R I C A L S H O R T - C U T S

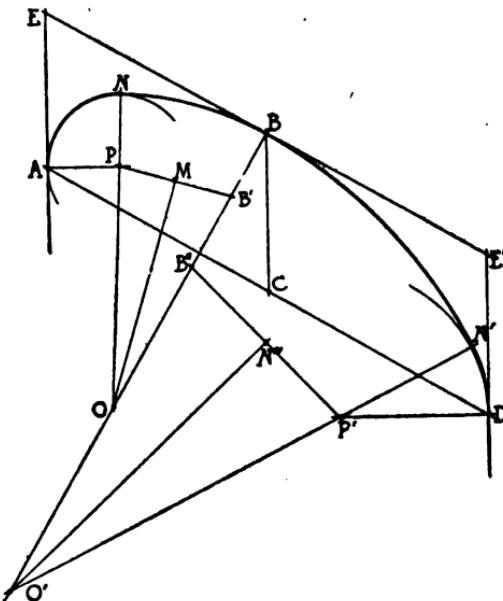


Figure 6
Rake Ellipse by Approximation

may be used as center with AP as radius in describing arc AN, fitting closely the sketched in curve.

Next, at B draw a line BO' perpendicular to EB.

Lay off BB' equal to AP, and draw MO bisecting PB' and perpendicular to it.

OVER THE DRAWING BOARD

MO will intersect BO' at O. Draw OPN through O and P giving the point of tangency, N, on the arc AN. Draw arc NB with O as center and OB as radius.

Next draw P'D perpendicular to E'D at D and locate P' by trial so that the arc N'D drawn with P' as center and P'D as radius fits closely this part of sketched in curve.

As before, lay off BB" equal to P'D and find where the perpendicular bisector of B"P', N'O', cuts BO' at O'.

Draw O'P—through N', the point of tangency on N'D and draw arc BN' with O' as center and O'N' as radius.

This completes the curve and it is obvious that the laws of tangency have been followed and that when these are thoroughly understood any curve may be approximated by a combination of arcs.

Egg-Oval by Approximation

Figure 7 shows an egg-oval, whose extreme diameters, AB and CD, are given, constructed of arcs. AP is made equal to one half CD, and CD then drawn perpendicular to AB at P.

Draw the semi-circle CAD. Lay off OB on AB, less than AP. The variation of OB determines the shape of the oval, the shorter it is, the more pointed the oval becomes.

GEOMETRICAL SHORT-CUTS

Draw a circle with O as center and OB as radius.

Draw OD' parallel to OPD intersecting the smaller circle at D'.

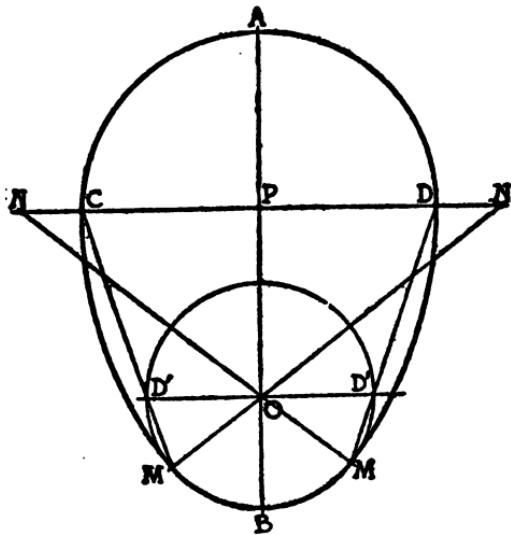


Figure 7
Egg-Oval by Approximation

Draw DD' through to M on the smaller circle.

Draw MON to N on CD continued.

Draw an arc with N as center and ND or NM as radius, on each side. This completes the oval.

All the laws of tangency have been observed and the geometrical proof of the equality of ND

OVER THE DRAWING BOARD

and NM is quite easy: NDM and D'OM are similar triangles, D'OM is isosceles since OD' equals OM, hence DNM is isosceles and DN equals NM.

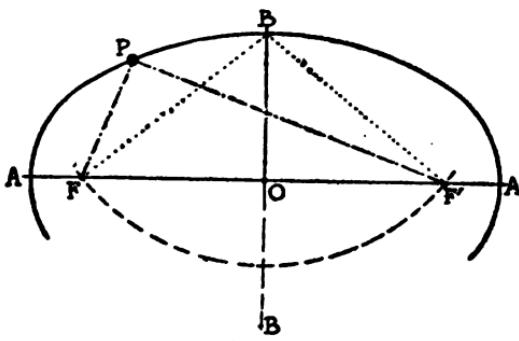


Figure 8

Drawing True Ellipse by String Method

Drawing a True Ellipse—Two Methods

It is often necessary to draw a true ellipse on a large scale drawing or for a full size template. This is usually done by one of two methods—by the aid of a string or by the use of straight-edges. We shall give both methods although the straight-edge method is far the more convenient and the more accurate.

The String Method

The major and minor axes of the ellipse are given, AOA and BOB, Figure 8.

GEOMETRICAL SHORT-CUTS

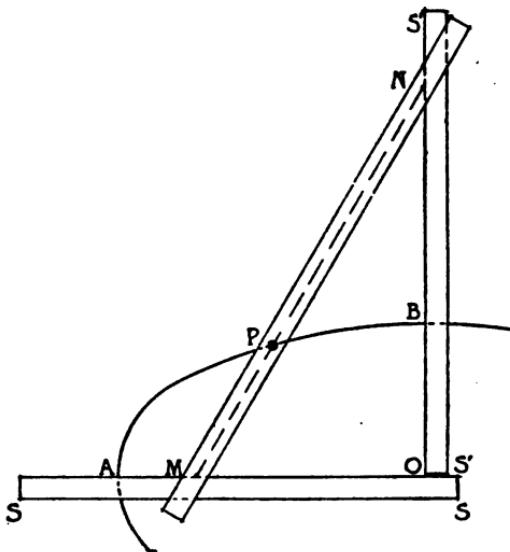


Figure 9
Drawing True Ellipse by Straight-Edge Method

Find the foci of the ellipse, F and F', by making BF and BF' equal to AO or OA—striking an arc with B as center and AO as radius cutting AO and OA in F and F'.

Place pins or brads at F and F' and fasten a string to these brads whose length FPF' is equal to AOA.

A pencil, P, holding the string taut will describe true ellipse APBA.

OVER THE DRAWING BOARD

The Straight-Edge Method

In Figure 9, straight-edges SS and S'S' are fastened or tacked along the major and minor axes of the ellipse to be drawn. Another straight edge is then arranged with a pencil or crayon at P and brads at M and N, making MP equal to BO and NP equal to AO.

If this straight edge is moved with the brads at M and N bearing against the edges SS and S'S' the pencil at point P will describe the true quarter ellipse APB.

It is evident that the length of SS or S'S' must at least be equal to MPN or half the sum of the major and minor axes of the ellipse.

A contrivance such as this may be easily arranged in the drafting room, shop or field and a true ellipse quickly and accurately drawn.

Spiral Curves by Approximation

The laws of tangency previously explained enable us to approximate a spiral curve with the compass. In fact it is these laws of tangency which underlie the various methods of drawing the Ionic volute with a compass. Figures 10, 11 and 12, show the method of drawing simple scrolls and their application to the drawing of a scroll stair newel.

Scroll Newels—Method of Drawing

Figure 10 shows a scroll composed of six arcs

G E O M E T R I C A L S H O R T - C U T S

and using six centers; Figure 11 shows another composed of five arcs and using five centers while Figure 12 shows a still simpler one composed of four arcs and using only four centers. The principle of laying them out is the same for all, the dotted lines on Figure 10 show how Figures 11 and 12 are merely parts of Figure 10. The following directions are for drawing the curves only as shown, which are pleasing, but which may be varied infinitely at will.

Begin by drawing a circle whose radius is two-thirds of the width of the hand rail. At the center of this circle draw a square whose side is equal to one-third the diameter of circle.

By dividing the sides of this square into six equal parts and drawing the cross lines, we divide the original square into thirty-six small squares. We may now locate centers 1, 2, 3, 4, 5 and 6 as shown.

Draw a line from 1 through C to p on the circle, p is the point of tangency for the first arc.

With 1 as center and 1p as radius, draw an arc intersecting 2-1 extended, at q, the point of tangency for the second arc.

With 2 as center and 2q as radius, draw an arc intersecting 3-2 extended, at r, the point of tangency for the third arc.

With 3 as center and 3r as radius, draw an

OVER THE DRAWING BOARD

arc intersecting 4-3 extended, at s, the point of tangency for the fourth arc.

With 4 as center and 4s as radius, draw an arc intersecting 5-4 extended at t, the point of tangency for the fifth arc.

With 5 as center and 5t as radius, draw an arc intersecting 6-5 extended at u, the point of tangency for the sixth arc.

With 6 as center and 6u as radius, draw a quarter circle intersecting 6v, perpendicular to 6u at 6, at v, the point of tangency for the straight rail.

The inner line is drawn in the same way using the same centers but radii in each case shorter by the width of the rail, v'v, than the radii of the outer arcs.

The other scrolls are drawn in exactly the same way but the tangent straight rail is drawn at the points u and t respectively, utilizing only parts of the whole scroll.

It will be seen that in every case the point of tangency and the respective centers of tangent arcs lie in the same straight line. Also that the point of tangency of the straight line and the last arc and the center of the arc lie in a line perpendicular to the straight line at the point of tangency.

The proportions and number of centers may be varied at will if only these principles are kept in mind.

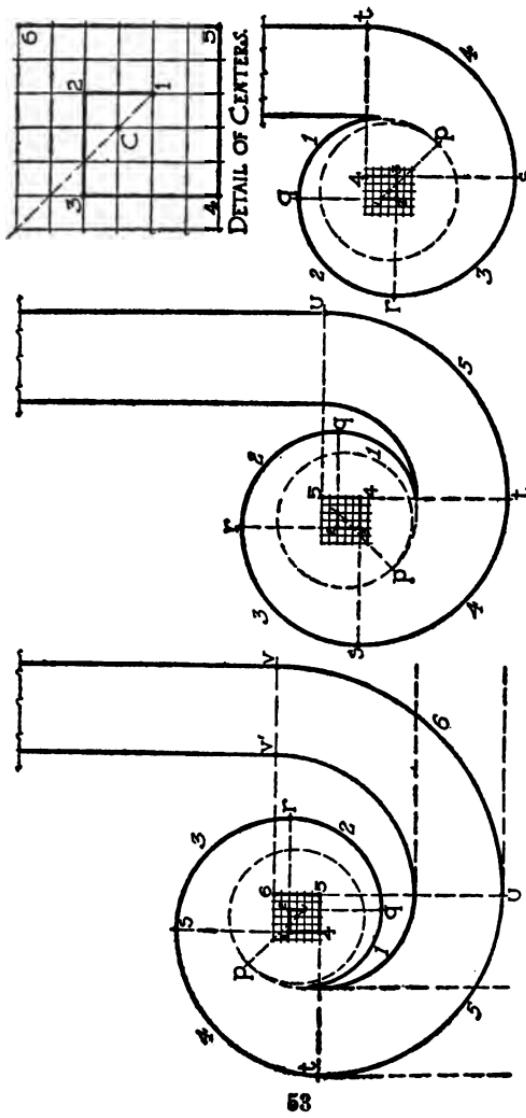


Figure 10

Method of Drawing Plans of Scroll Newels

Figure 11

Figure 12

Method of Drawing Plans of Scroll Newels

VI.

LETTERING, TITLING, NUMBERING

Lettering

The importance of lettering on a drawing is not recognized as much as it should be. The finest drawing may be utterly spoiled by poor lettering on it—poorly drawn or poorly spaced. In the composition of the sheet, the lettering is a vital element. No draftsman is competent unless he can do lettering, from the most informal free-hand to the most formal mechanically drawn, neatly and quickly. The whole subject of lettering is too important and too large to be treated here minutely. For those who care to study the subject—and every draftsman should—there are many valuable texts.

Guide Lines and Spacing

It is well to remember that in free-hand lettering, which is used almost exclusively on working drawings, rather faint guide lines top and bottom should be used. These lines tie the letters of the line together and tend to give it a more prim and proper appearance. The individual letters should be rather narrow and generously spaced. The generous spacing reduces the contrast between

LETTERING

letters and thus minimizes the evidence of irregularities. A line of lettering, generously spaced and between guide lines, though very hastily done will look much more ship-shape than a similar

NARROW AND WIDELY SPACED
LETTERS WITH GUIDE LINES -
Quickly Made and Very Ugly.
:WITHOUT GUIDE LINES- MODERN:
.COMBINATION Wide and Narrow:

Figure 13
Guide Lines in Lettering

line without the guide lines and closely spaced, though very slowly and painstakingly done. (Fig. 13).

Free-Hand Lettering, A Method

Lettering, even free-hand, is drawn and not written. Each stroke, as made, determines to a great extent the direction and position of the following strokes, hence the appearance and style of each letter depends somewhat on the sequence and directions of the several single strokes composing it.

1	2	3	4	5	1	2	3	4	1	2	3	4	5
↖ A A	A	I			1	↖ a a	a						
↖ P B	B	↖ 2	2		2	↖ b b	b						
↖ C	C	↖ 3	3	3	3	↖ c c	c						
↖ D	D	↖ 4	4	4	4	↖ d d	d						
↖ E	E	↖ 5	5	5	5	↖ e e	e						
↖ F	F	↖ G	G	6	6	↖ f f	f						
↖ G G	G	↖ 7	7	6	6	↖ g g	g						
↖ H H	H	↖ 8	8	8	8	↖ h h	h						
↖ I	I	↖ 9	9	9	9	↖ i i	i						
↖ J	J	↖ O	O	O	O	↖ j j	j						
↖ K K	K					↖ k k	k						
↖ L L	L					↖ l l	l						
↖ M M M	M					↖ m m	m						
↖ N N	N					↖ n n	n						
↖ O O	O					↖ o o	o						
↖ P P	P					↖ p p	p						
↖ Q Q	Q					↖ q q	q						
↖ R R	R					↖ r r	r						
↖ S S	S					↖ s s	s						
↖ T T	T					↖ t t	t						
↖ U U	U					↖ u u	u						
↖ V V	V					↖ v v	v						
↖ W W W	W	W	W	W		↖ w w w	w						
↖ X X	X	X	X	X		↖ x x	x						
↖ Y Y	Y	Y	Y	Y		↖ y y	y						
↖ Z Z	Z	Z	Z	Z		↖ z z	z						
						ABCDE							
						FGHIJK							
						LMNOP							
						QRST							
						UVWX							
						YZ							
						&							
						1234567							
						890							
						abcde							
						fghijkl							
						mnopq							
						rstuvwxyz							
						xyz							

Figure 14
A Method of Free-Hand Lettering

L E T T E R I N G

Of course, lettering will with practice, like handwriting, show the individuality of the letterer, but the individuality expressed is usually a subtle one and may be more evident in the composition of the words and the lines rather than in the individual letters, and the lettering will always resemble a model prototype more closely than handwriting.

Figure 14 shows an upper and lower case alphabet and numerals with each character in the successive stages of its construction and finally with its finishing touches. A little practice on this will convince the student how much more easily the letters can be constructed neatly and quickly by making the various strokes in the order and directions as indicated. Take any letter, for instance "e." It makes a great deal of difference whether the letter is attempted in one or two strokes of the pen as usually done, or whether it is made in three strokes as shown: first, the top curve to the right, then the rest of the curve downward and to the right, and finally the cross bar. A single trial will probably convince the draftsman of the desirability of drawing the curved part in two strokes rather than one. The same is true for the "c" and the "s." With practice some of the strokes may be combined, especially in small letters.

OVER THE DRAWING BOARD

Style and Spacing

As for style, the letters may be varied from the extremely attenuated type to the very broad and rounded. Spacing may be varied at will, but a well spaced line of lettering when seen at some distance should appear of uniform color, not spotty with conspicuous light and dark spaces. Charming line composition may be obtained by a proper combination of the attenuated and broad types of letters used side by side.

Lettering Backwards to Facilitate Spacing

Quite often in working to a right-hand margin or in filling a given space with a line of lettering, it is very convenient to work backwards from the right margin or end of the line. For instance in lettering the word, "ELEVATION" in the right-hand corner of a sheet, it is far more accurate to place the "N" at the right margin, then in succession the "O," "I," "T," "A," etc., ending with the "E," than to do it in the ordinary way from left to right and trusting to hit the right margin or end by instinct. Again assuming that we want to place the legend, "DINING ROOM PLAN" in a line four inches long and in the center of the sheet, we mark off the four inch space in the center as we want it and letter "DINING" from left to right in the usual way and beginning at the left end of the line. We then letter "PLAN"

L E T T E R I N G

backwards from right to left and beginning at the right end of the line. It is then comparatively easy to place "ROOM" in the center of the remaining space.

Titling and Numbering Drawings by Tracing

In these days when sets of drawings sometimes number a hundred sheets or more, the uniform titling of these sheets becomes an overwhelming task if done individually by hand. Various schemes and devices are used to lessen this labor. The simplest scheme for small jobs where there are not over fifteen or twenty tracings, is to letter carefully a title on a piece of paper, putting on it guide lines so that it may be properly registered

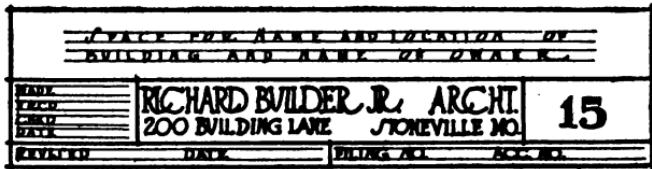


Figure 15
Suggestion for Form of Title

under each tracing. The title may then be traced easily and quickly on each sheet. The numbering of each tracing may be neatly and quickly done by placing a suitable calendar leaf under the number space and tracing the number therefrom. It is well to adopt a standard form of title, (see

OVER THE DRAWING BOARD

Figure 15), leaving the owner's name, the date, number and so on, blank, filling in these spaces properly in each case.

Rubber Stamps for Titling

In some offices rubber stamps are used for the title form and the various spaces are filled in by hand or a rubber stamp is made for each job and used on the tracings. Rubber stamps are not satisfactory, however. No stamping ink is on the market which when used on tracing cloth gives a satisfactory impression on the blue print. Again it is extremely difficult to get a clear, clean impression from a rubber stamp.

Printing Titles from Zinc-Cuts

A far better device is used in many offices, especially for large sets of drawings. The title is carefully lettered at large scale on white drawing paper in black ink. From this, at small cost, a zinc etching or cut is made. This cut or printing block is then inserted in a wooden frame or box with a hinged cover, so that the cover, which has an opening in it a little larger than the cut, when closed down is flush with the printing surface of the block. The tracing is now tacked to the cover, face down, with the title space over the opening, black printing ink is applied to the cut with a regular ink roller, the cover with tracing is closed down and the back of the tracing is

L E T T E R I N G

rubbed over the inked cut. A clear, clean-cut imprint is the result. This is by far the easiest and best way to title a number of sheets uniformly.

Systems of Numbering

The system of numbering is also capable of considerable variation. The simplest thing to do is to number consecutively. It is better, however, to separate the drawings into classes, which allows for insertion of drawings without breaking the chain of numbers and also serves as an index to the character of the drawing. The following table will illustrate the point:

1—99, General Drawings

100—199, Scale Details

200—upward, Full size details

or a more elaborate subdivision for very large sets:

1—99, General floor plans

100—199, General sectional drawings

200—299, General elevations

300—399, Scale details, exterior

400—499, Scale details, interior

500—599, Full size details, exterior

600—699, Full size details, interior

These tables may be varied in many ways but it is well to adopt a system and use it for all sets of drawings, however small.

OVER THE DRAWING BOARD

Numbering in All Corners

It is also convenient to number sheets in all four corners. This makes it much easier to identify drawings on the work where it is hardly to be expected that the sheets will be kept in any sort of order.

Preparing Sheets with Border Line and Title

It is always well to cut and prepare in advance, with border line and title, the necessary sheets for any particular set of drawings. This may be done by the assistant or student in the drafting room. For drawing the border lines it is convenient and time-saving to use a template drawn on paper showing the border line and outside trimming line with guide or register mark for the title. The sheets of tracing cloth or paper may then be placed over this successively and the necessary lines traced off.

Titling Originals

It is well to title original drawings as they are made so that the record of dates and draftsmen may be kept upon them. A rubber stamp with outline of suggested or similar title form is excellent for this. This title form should be stamped in one corner of the sheet of paper before the drawing is begun.

VII.

WORKING DRAWINGS, INDICATION, LINES

Function of Working Drawings

Just how is the function of the working drawing best fulfilled on the actual work? A working drawing is first of all a message to the workman, a record of the facts, data and information necessary for him to be able to do a certain piece of work in accordance with a certain scheme and idea, usually of another. The working drawing fails in its mission unless this message is delivered without the least ambiguity. The message itself should be clear and the lines presenting it should be clean-cut and distinct. Again the working drawing should look well for no drawing should ever leave the architect's office that doesn't look well. A slovenly drawing is reflected in slovenly work which is done under its guidance and the designer can hardly expect neat workmanlike results, beautiful results, from a drawing which is neither clear nor beautiful.

Tracing and Blue-Print

The draftsman should remember that neither the original drawing, nor the tracing, these days, does duty on the work, but that the print made

OVER THE DRAWING BOARD

from the tracing is the form of the message from him to the workman. The problem then becomes to make an original which may be traced accurately and intelligently by some one other than himself, if necessary, and then to make a tracing which will produce a good, easily read blue-print. This is the really important thing—the making of a tracing from which a perfect blue-print may be made. No matter how legible and beautiful a tracing may be if it does not produce a legible and beautiful print it is well nigh useless as a working drawing.

Original Drawings

The original paper drawing is being gradually eliminated, especially on small work. Where the same draftsman makes the original and traces it, he may employ many short-cuts. The original may be merely blocked out on paper then finished on the tracing itself or it may be made on the tracing cloth or paper and when finished simply inked in and cleaned. It is always safer to have a penciled original fairly complete before tracing is begun. A good way is to make on drawing paper, say, the most important floor plan and elevation, then to develop the other plans and elevations in pencil on tracing paper laid over these first drawings, thus saving much scaling and measuring. The whole job may then be traced,

W O R K I N G D R A W I N G S

with the added advantage of being able to assemble several of the loose sheets for tracing on larger sheets. This is very convenient where standard size sheets are used for all work.

The important idea in working drawings remains, that the blue-print is what is used by the workman in the shop and the field, that it is the form in which he receives the message from the designer. The tracing is not the end but merely the means to the end and if the means are to best fulfill their function, the end must be kept in view constantly and it will be in all suggestions that follow.

Scales of Working Drawings

The first thing to be considered in a working drawing is the scale. The drawing, especially the general drawing to be used on the work, should not be so large as to be unwieldy. On very large work the scheme adopted by Messrs. McKim, Mead, and White on the New York Municipal Building is an excellent one. In this case the general drawings were made in sections at a large enough scale to be quite legible and on each partial drawing was an index diagram or key drawing at very small scale with the part which was the particular subject of the sheet, clearly indicated. It is a mistake to crowd in too much drawing at small scale.

OVER THE DRAWING BOARD

Indication vs. Representation

Clear indication is far more valuable than complete representation. Broadly speaking, the smaller the scale the less actual representation must be indulged in and the more indication must

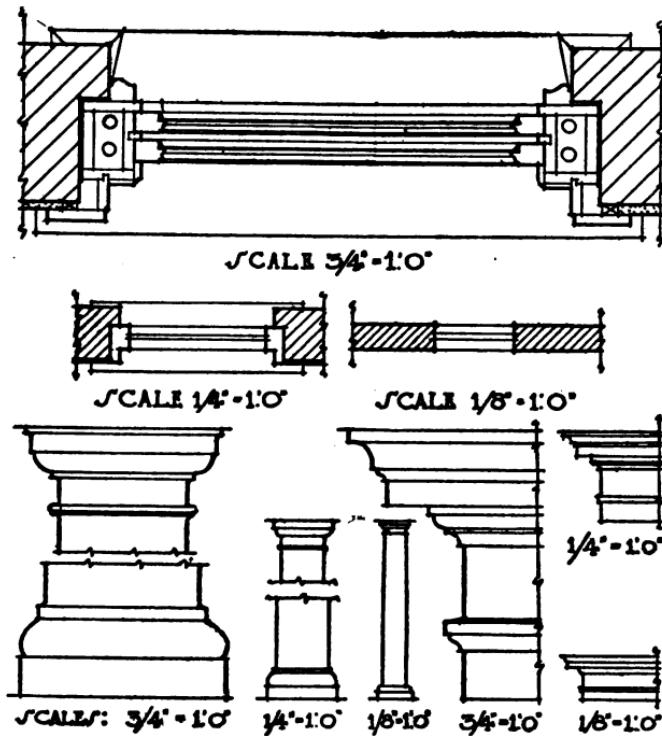


Figure 16
Indication at Various Scales

WORKING DRAWINGS

be relied on. It must be remembered that the function of general working drawings at small scale is to show general dimensions and general relations of parts and enough drawing to show this, is enough. Figure 16 shows some examples of indication at various scales.

Silhouette Lines

While we are talking of lines we must not forget the value of the silhouette line. In drawing elevations, especially, this is extremely useful. We simply take the important masses or parts which, although they may actually be in widely separated planes, appear in one plane on our drawing, and differentiate them by outlining them with a stronger and more prominent line. This may be done by using a black ink line on a watered ink drawing or by making the line wider. Aside from its pictorial value in adding brilliancy to the drawing it makes the drawing much more easily read.

Corners and Intersections of Lines

If you want to know something of the character of the draftsman who made a drawing, look at the corners where lines intersect but do not run through. If the lines just miss intersection, the draftsman is slovenly or afraid of himself, if they meet very precisely and exactly, he is probably very painstaking and slow, if they cross at

OVER THE DRAWING BOARD

the corners, he is probably very efficient and quite sure of himself. It is certain that nothing will hurt the appearance of a drawing more than open corners, lines that should intersect, remaining apart, while hardly anything adds so much snap, vigor and the appearance of certainty to a drawing as the slight crossing of lines at corners. This crossing at corners also saves much time, for the draftsman is not held down by the psychological handicap of being afraid that he will carry his line too far. The instant he crosses his line he lifts his pen or pencil, he does not have to worry about slowing up to meet the other line exactly.

Studying Scale Drawings

In making a scale drawing it is very often of great advantage to study parts of it at a very large scale or even full size. The indication on the smaller scale drawing can then be made much clearer and more vivid. Indication on a working drawing is after all a process of elimination, of leaving out rather than putting in. The smaller the scale the more must necessarily be left out—and one must learn to leave out wisely. For general working drawings the scale of $1/4"$ to the foot is mostly used in this country. On large work this scale may be reduced to $1/8"$ or even $1/16"$. On small work it may well be enlarged to $1/2"$ or $3/4"$. For detail work, the scales of $3/8"$,

WORKING DRAWINGS

$\frac{3}{4}$ ", $1\frac{1}{2}$ ", and 3" to the foot are much to be preferred over the scales of $\frac{1}{2}$ ", 1", etc., for with the former, distances may be accurately scaled off with an ordinary rule for the inch divisions are $\frac{1}{32}$ ", $\frac{1}{16}$ ", $\frac{1}{8}$ ", and $\frac{1}{4}$ " respectively. This is a great advantage on the work or in the shop. Much compactness may be gained in making detail drawings at the scale of $1\frac{1}{2}$ " or 3" to the foot and showing the profiles of mouldings, ornaments and other important details at full size in conjunction with the scale drawings.

General and Detail Drawings

It has already been said that the real function of the general working drawings at small scale is to show the general disposition of the parts of the work and the relations between them. It remains for the detail drawings to show more clearly the character of these parts — first the scale detail drawings showing the relations and layout of the individual minor parts which go to compose each major part and then the full size details which show the precise character of the important individual minor parts. For example, the general drawings would show the width and height of a window, the general character of its design, its position in the wall,—the scale detail would take that window without relation to other windows or other features perhaps and show the

OVER THE DRAWING BOARD

relation of its parts, more clearly than the general drawing could show it; the full size detail drawings would then show the section of the sill, the profile of the architrave moldings and so on.

Making Detail Drawings—the Old Way

The ways and means of making detail drawings have undergone a greater change than any other phase of drafting room practice. By the character of his detail drawings, an architect must either rise or fall. If carefully worked detail is to be had, the drawings which direct the workmen must be worthy of the details.

Not so many years ago, detail drawings were made, almost universally, on heavy drawing paper, these originals were turned over to the workman in the shop who, when the shop-work was finished, sent the drawing to the building with his material or part of the work. A paper tracing in pencil was usually kept as the office copy. This system has many faults. For a detail drawing of something which was to be made by one craftsman it was fairly adequate, for almost any other purpose it was entirely inadequate. The making of the office copy was usually relegated to the office boy or "cub" with more or less accurate results, usually less. By the time it reached the building, the original drawing was often illegible and partly worn out. It was rarely possible to confine each

W O R K I N G D R A W I N G S

detail drawing to one craft only with the result that there was usually a scramble for the "details" by two or more craftsmen whose work overlapped and had to be illustrated on one sheet. This system is quite inadequate and impractical now and has little reason for its existence.

Making Detail Drawings—the New Way

The original detail drawings may be just as easily made on tracing paper in pencil, or ink if necessary occasionally, and as many blue prints, actual accurate copies, as needed made from the tracing paper original. Where much erasing and handling is apt to be required, tracing linen may be used, but usually the paper is sufficient and preferable. The best paper for this purpose is a white paper of medium weight similar to "Economy."

Full Size Details

Much effort and time can be wasted in the making of a full size detail. For instance, let us consider an entablature ten feet high. It would be absurd to make a full size detail of this in its entirety although it is often done. The workman does not need it. On the other hand it is quite essential that the architect study the entablature full size in its entirety either in the drawing, in the model or both. After the studying is complete, the workman can get along more

OVER THE DRAWING BOARD

conveniently with a scale detail of the entablature with the principal dimensions marked and full size details of essential parts and profile, carefully indexed and referred to the scale drawings, all on a sheet probably three by four feet.

Again, after the entablature has been carefully studied in its entirety the parts may be rearranged and assembled on a much more compact sheet, using a scale index drawing if necessary—with practically no loss of legibility and clearness and much gain of convenience to both draftsman and craftsman.

Shrinkage of Blue-Prints

It is often well to dimension full size details because blue-prints shrink on drying after the developing process. This shrinkage is sometimes insignificant but often important. In precise work it is therefore better to put on at least general dimensions on full size details especially if they are not accompanied by fully dimensioned scale or index drawings.

Symmetrical Details

In a detail of a symmetrical object the workman needs a drawing of only one-half or less, depending on the number of repeated units about the axis or axes. This may save a great deal of time. Although it is often desirable to study the

WORKING DRAWINGS

whole of a symmetrical object, in charcoal or by drawing half and using a mirror, or drawing half and roughly transferring the other half or similar unit, it is entirely unnecessary to show more than one of the repeating units in the actual working drawing.

Studying Details

In the preliminary study of details by the draftsman, is the field where he may most forcibly show his ability and training. This preliminary study may be very conveniently done on tracing paper as already mentioned. It may be done with soft pencil or charcoal — charcoal has the advantage of being easily wiped out—and may consist of any one or all stages between the crudest free hand sketch and the elaborately rendered drawings of Mr. Platt's office previously mentioned. For the study of ornament or moulding profiles it is often convenient to stand the drawing board vertically—in fact it is difficult to judge details at large scale or full size unless the board is placed vertically and the observer can get a reasonable distance away.

Mirror in Symmetrical Drawings

In studying symmetrical details, such as capitals or balusters, only one-half need be sketched, the effect of the whole may then be seen by holding

OVER THE DRAWING BOARD

a mirror with its edge on the axis of the detail and its surface perpendicular to the surface of the paper—this is a very useful and time saving expedient.

Color to Indicate Materials

In the days when the original drawings or original tracings were used on the work it was the common practice to indicate various materials by different colors. When the blue-print came into common use color was still used as the index to different materials—the blue prints being colored by hand, one by one. This, besides being quite unsatisfactory, entailed an immense amount of labor and involved a great chance of error. It was highly improbable in several copies of a complex drawing, that every copy would be colored exactly alike.

Hatching to Indicate Material — Standard Indications

On this account, the practice grew to use hatching and cross hatching of various designs on the tracing to indicate the different materials and this method has almost entirely supplanted coloring. There is urgent need for standard symbols of indication of materials on working drawings and such standards are now being compiled and considered by committees of various technical so-

WORKING DRAWINGS

INDICATION OF MATERIALS.

SECTION		ELEVATION
	Brick	Face Brick
	Stone Masonry	
	Concrete Stucco	
	Cut Stone	
	Hollow Tile	Hollow Tile
	Terra Cotta	I. C.
	Marble Slab	
	Wood or Frame	Wood
	Iron Steel Metal	

Materials are often indicated by name, especially in Elevation, as follows:—
 Siding: Shingles: Bronze: Copper: Tin
 lead: Glass: Galvanized Iron: Cast Iron
 etc.

Figure 17
 Chart of Suggested Indication of Materials

OVER THE DRAWING BOARD

cieties. Each drawing should have an index showing small panels of the indications used with the name of the material indicated, beside it. Figure 17 is a chart of indications of material which have been found useful and easy to draw.

Watered and Colored Inks in Indicating Material

This hatching and indication is best done in watered ink on ink tracings or in gray pencil lines on pencil drawings. The structural lines enclosing this indication are made in black ink or strong pencil lines. The resulting blue-print is then snappy and very legible, the important lines standing out in clear brilliant white while the hatching comes out in a subdued pale blue. The only advantage in using colored inks for hatching—they show up in the blue-print about the same as watered ink—is that the draftsman is less liable to error in making a complicated drawing when he has the added differentiation of color at his command. This is particularly true of dimension lines which are almost invariably drawn in red or green ink.

Scale of Indication

It should be remembered that the smaller the scale of the drawing, the smaller in scale and finer the hatching and indication should be, while the larger the scale of the drawing, the larger in scale and coarser this indication may be.

WORKING DRAWINGS

Dimensioning of Drawings

The dimensioning of a drawing should be most carefully studied. There is much danger of underdoing it and almost as much of overdoing it. The dimensions should be put on logically and in conformity with the methods of the workmen so as to relieve them as much as possible of the necessity of calculation. For instance, a carpenter usually sets window frames and other units by their centers, it therefore burdens him with calculation and exposes him to error if the dimensions for windows say, are given in distance apart and width. It would be much better for him if the windows were figured center to center and width. Again, studding partitions should always be figured center to center or to one side, for variation in thickness of plaster and dimension of lumber makes their finished width a somewhat uncertain and variable quantity. So practical limitations and requirements must always be borne in mind in putting working dimensions on drawings. Accuracy is a most important requirement. An incorrect dimension is far worse than one omitted entirely. The omitted dimension simply compels the workman to depend on scaling but the incorrect figure misleads him and may cause him much trouble before it is discovered.

OVER THE DRAWING BOARD

It is advantageous to have the dimension figures all read one way, that is, even when the dimension lines are vertical, to have the inset figures read horizontally. This adds to the convenience of using the drawing.

Notes on Drawings; Specifications

Explanatory notes are a very necessary and important part of working drawings. Most architects depend too much on specifications. These should supplement and reinforce the working plans rather than be a part of them. In other words, the working drawings should be so carefully made with ample indication of materials and explanatory notes that they should in themselves furnish sufficient data for the proper doing of the work they illustrate. The specifications should be merely a supplementary brief of what the drawings tell, a summary and index, calling attention to features of the work.

Original Tracings Not To Be Used As Office Copies

Original tracings of working drawings should never be used as office copies especially on important work. We must recall that tracings are made only as a means toward the end of producing the blue prints which actually do service as working drawings and they should be kept in good condition for this purpose—the making of prints.

WORKING DRAWINGS

The tracings should be filed carefully and safely so that clear prints may be made at any time, years after the work is completed, if necessary. If the tracings are used for office reference they become dirty and crumpled and it is practically impossible to make legible prints from them.

Blue-Prints for Office Copy

One or more extra sets of blue prints should always be made for office use—if the work is important and the drawings require much handling, these prints should be made on cloth.

Photographs of Drawings for Reference

On work where the drawings are numerous and the sheets large it is well to have a set of photographs of convenient size of all the drawings. Very often general questions may be settled by examination of the photographs alone but the greatest convenience of these is their use as an index to the complete set. When any question is to be looked up it is extremely convenient to run through the photographs and find quickly the particular drawing pertaining to the question at hand, this may then be found in the regular set without the handling and thumbing over of dozens of cumbersome prints.

VIII.

SKETCHES, EXHIBITION DRAWINGS, WATER COLORS, PERSPECTIVE

Studies and Sketches, Character of

Studies and sketches are of two distinct kinds; those made by the draftsman as steps in his development of the solution of a problem, his notes as it were, and those which are intended as a preliminary presentation of the idea after considerable study and after its principal features have been determined. The first are usually not intended for the client—the second usually are made for the client, for exhibition or publication.

Paper and Media for Sketches

When the uses and advantages of tracing paper were described, we discussed study sketches fully and also touched on the other kind. Finished sketches may be made in almost any medium and on almost any kind of paper, in lead pencil, charcoal, colored crayon, ink, both black and colored, water-color, both transparent wash and opaque and even oil-color. All kinds of tracing paper, tracing cloth, every kind of drawing paper, mat-

S K E T C H E S

board, straw-board and various kinds of cover papers and wrapping papers have furnished the backgrounds for these media.

Soft Pencil and Tinting

Soft pencil has already been spoken of as used on tracing paper, its possibilities in combination with crayon tinting and water-color are unlimited. A drawing may be completely rendered in soft pencil—if large, in charcoal—and then judiciously tinted in water-color, or entirely painted over using the original drawing simply as a guide to values. All of Mr. F. Hopkinson Smith's delightful water colors were made in just this way—finished in charcoal and fixed—then the shadows colored with transparent water color and the lights and high lights done with opaque color, that is, color having a base of Chinese White.

Paper for Pencil

For drawings to be left in pencil, besides the various grades of tracing paper which are so useful and so pleasant to work on, there is the English Metallic Sketching paper, a smooth paper with powdered glass in its composition making it a delight for pencil work.

A paper of similar surface and quality is the "Cameo" paper used by printers. This comes in several tints and many weights, is quite easy to

OVER THE DRAWING BOARD

get and is less expensive than the English Metallic paper. Its surface is nearly as good. Lead pencil is probably the medium of the widest latitude for architectural drawing.

Pen and Ink

One cannot look upon the drawings of D. A. Gregg, Harvey Ellis, Joseph Pennell, Bertram Goodhue and many others without realizing the wonderful possibilities of pen and ink for architectural rendering and sketching. A good pen and ink drawing may have all the good qualities of an etching.

It may be made on tracing paper or cloth over an outline drawing just as the soft pencil drawing may. A pen and ink drawing made on cream colored tracing paper, trimmed and mounted, has the rare quality of an India proof.

Brown Ink

A pen and ink sketch may be made with brown ink and then washed over with weak tea or coffee or water color. This softens the ink lines somewhat and gives the richness and mellowness of an old etching.

Photo-Enlargement of Drawing

A pen and ink or pencil drawing made at small scale may be photographed and enlarged to two, three or even four times the scale of the original.

S K E T C H E S

The enlargement may be toned a sepia. The result is of surprising vigor. The lines show a boldness and strength that few draftsmen dare to put into an original except perhaps when working with crayon or charcoal. By this means of photo-enlargement a small sketch may often be made into an exhibition picture of great strength and carrying power.

Water Colors

Water colors may be used in many different ways by the draftsmen. Most draftsmen make the mistake of using too many colors and not becoming acquainted with the possibilities of their color box before trying to use color as a medium of expression. To cultivate a method of acquainting oneself with color pigments, an eight-pan school color box which costs twenty-five cents is very useful. These boxes usually contain standard red, orange, yellow, green, blue, violet and a black and a white.

Experiments in Color

On a piece of white paper draw five rows of seven half-inch squares or triangles in each row—Figure 18.

The squares of the first row are to be filled in with the six colors and black as strong as they can be mixed with water, that is, using the colors at their fullest intensity.

OVER THE DRAWING BOARD

The squares in the second row are to be filled in by tints of the colors made by reducing each color with water.

Each Color Full Strength	R	O	Y	G	B	V	Bl.
Mixed with Water							
Mixed with White							
Mixed with Black & White							
Mixed with Complementary							

Figure 18
Chart for Experiments in Color

The squares of the third row are to be filled in by tints of the colors made by reducing each with white.

For the fourth row we reduce each color by adding black and white—this tends to neutralize or gray the colors.

S K E T C H E S

For the last row we try to neutralize each color by adding its complementary, that is, to the red we add green; to the orange, blue; to the yellow, violet; to the green, red; to the blue, orange; to the violet, yellow; and to the black, white. This gives us a series of modified grays.

Experiments should now be made, placing colors next to each other or one around another to note the modification thus possible, also by putting various colors around spots of neutral gray and noting the effect on the gray—the gray will tend towards the complementary of the color around it. Such experiments will show some of the possibilities of a color box.

A set of a few colors with its possibilities known thoroughly, is much better than a set containing many and used haphazardly.

Selection of Pigments

Very few water-colorists use the same selection of pigments for their work. Some use only six colors while others as many as eighteen or twenty. Harpignie, the eminent French water-colorist who first rendered his paintings in monochrome, using neutral tint for the purpose, and then colored them, used a palette of eighteen colors. The architectural draftsman can get along with six and should certainly find twelve or fourteen

OVER THE DRAWING BOARD

enough for all his needs. It is surprising how much can be done with the following six colors:

Yellow Ochre

Gamboge

Carmine

Light Red

Cobalt

Prussian Blue

The addition of the following:

Chinese White

Aliziran Crimson or Vermillion

Vandyke Brown

Emerald or Viridian Green

Mauve

Neutral tint or Charcoal Gray

will make an excellent color box which may be used for almost any purpose and with which the six standards may be closely approximated, if desired.

Tinted Outline vs. Painting

A sketch, where the outline is well and snappily drawn needs but very light washes of color to give it much additional interest and life. Here the outline drawing itself remains the important thing. This must be distinguished from the real water-color rendering where the outline is merely

S K E T C H E S

the edge of an area of color and not a drawn line. Architectural draftsmen often fail as water colorists because of being handicapped by their reliance on the drawn outline. A drawing may be colored or tinted effectively but it should remain a drawing, the drawn lines being of major importance. A painting is a mosaic of areas of color and the drawn outline is merely a guide to the proper placing of these areas—and should have no prominence in the finished result.

Transparent and Opaque Colors

As to whether transparent washes or opaque colors should be used is a matter of taste. Beautiful results have been obtained with either and with a combination of both. Mr. F. Hopkinson Smith's rule to use transparent washes for the shadows and opaque color for the high lights, surfaces which reflect light, is a logical one.

Composition

As a foundation for pictorial work the draftsman should study composition. He should grasp every opportunity to see and analyze good pictures and drawings. When he likes a picture he should always ask himself why he likes it and try his best to find the answer. When he is dissatisfied with his own work he should always ask himself why he doesn't like it. If we know why a thing is not good, we can usually make it better.

OVER THE DRAWING BOARD

Essentials of Composition

A few things are essential in composing a drawing—there should be a principal point of interest, there may be minor points of interest and their arrangement should be a balanced one. The principal point of interest should not be in the exact center but rather to one side and above or below the center. No point of interest should ever come near the edges and particularly not in the corners. More pictorial drawings have been ruined by not following this one little rule than in any other way—interest and attraction should be kept out of the corners of a picture.

Formal Studies

Studies are often much more formal in character than the sketches already described. Competition and exhibition drawings often show a vast amount of labor. No draftsman could help being inspired by such masterly drawings as those made by Mr. Eggers and Mr. Jules Guerin for the Lincoln Memorial.

Shades and Shadows

On formal drawings, it is customary to cast shadows with mathematical correctness and every draftsman should familiarize himself with the methods of doing this accurately and quickly. Shadows at once add the third dimension to a two-dimensional drawing and nothing perhaps will

S K E T C H E S

add brilliancy to an architectural drawing with less effort than the shades and shadows accurately drawn. A mere outline drawing, when the shadows are accurately and snappily outlined and then washed in lightly so as to be just visible, becomes a pictorial presentation of quality.

Monochrome Drawings

Competition drawings are now nearly always rendered in monochrome and often in Indian Ink. Where water-color is permissible a monochrome drawing may be given much warmth and life if the paper is first given a thin wash of yellow ochre and the drawing rendered in Ivory black or Sepia. The yellow ochre foundation blends and warms and harmonizes the whole work. Ivory black also has the quality of settling beautifully and giving an interesting texture.

Settlement in Water Color

To obtain settlement in a water-color wash, the color should be laid on plentifully with a full brush and the wash, when once laid on, not disturbed until dry. It is the taking advantage of the peculiarities of the medium used that lifts a drawing above the commonplace, and shows the skill of the draftsman.

Brush Technique

The possibilities of the brush and its technique

OVER THE DRAWING BOARD

should also be studied, and painting either from copy or from nature such subjects as simple flowers and leaves with little or even no drawn outline as guide, will develop a much to be desired ability to use the brush properly.

Perspective, Geometric

A thorough knowledge of Geometric perspective is also of great value to the draftsman and designer. Next to the model, the perspective drawing best illustrates the appearance of an object. With many draftsmen the making of a perspective is a tedious and much disliked task. It need not be if he understands thoroughly the few essential principles underlying the science. The author's text book, "Perspective," is a concise, simple book boiled down to the essentials and presented after the manner of modern teaching and written particularly for the home student. Careful studying of this or some other text on the subject is the only way to learn it and it is worth while for every draftsman.

Perspective, Free-Hand

Free-hand perspective is of two kinds, that drawn from Nature and that built up after the manner of geometric perspective but without the actual mechanical laying out of the points and projections. A knowledge of geometric perspective is less necessary to the first than to the second

S K E T C H E S

but is helpful in both. To draw from nature, training of the eye to observe properly and training of the hand to follow the eye instinctively are necessary. These come from plentiful practice. For the second, a sort of impromptu laying out of perspectives, a thorough knowledge and long practice of the geometric science are quite necessary. In fact, it is only after many years of practice of geometric perspective and practice at drawing from Nature that any one can hope to lay out a perspective free-hand with truth and accuracy in the result.

Aids in Free-Hand Perspective

There are many aids to this. The best of these helps is the dividing up of the subject into convenient rectangles and blocks. It is easy to learn to draw a rectangle or block in any position. If we divide our object, a building for instance, into a number of convenient rectangles and blocks, it simplifies the drawing very much. This will be shown in Figure 23 after some of the peculiarities of rectangles in perspective have been described.

Diagonals and Centers

In the perspective of rectangles, the use of diagonals is of the utmost value in finding centers and dividing spaces. Figure 19 shows the method of finding the perspective center of any rectangle in perspective by simply drawing the diagonals.

OVER THE DRAWING BOARD

The lines AD and BC are the perspectives of the diagonals and their intersection must be the perspective of the center. (See "Perspective," Page 53).

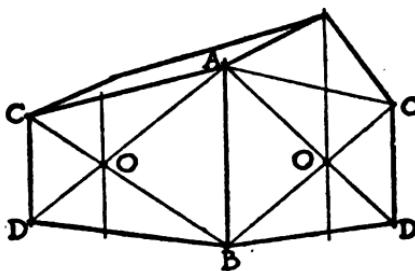


Figure 19
Diagonals and Perspective Centers

Even Divisions

By this method a space may be divided correctly into 2, 4, 8, 16 . . . parts by first finding the center and then the center of each half and so on. (Fig. 20).

Odd Divisions

A space may be divided into any number of equal parts by another simple method illustrated in Fig. 21. To divide the perspective rectangle ABCD into five equal perspective parts, we may divide the verticals AB and CD, each into five equal parts connecting the division points by horizontal lines in perspective. If we now draw

S K E T C H E S

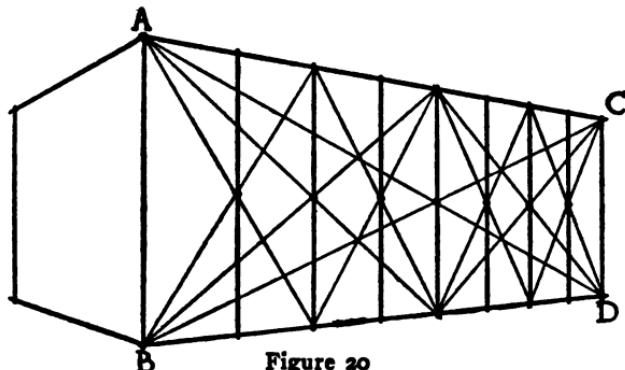


Figure 20
Even Divisions in Perspective

either diagonal, the diagonal will intersect the horizontal lines in points through which verticals may be drawn dividing the rectangle into five parts.

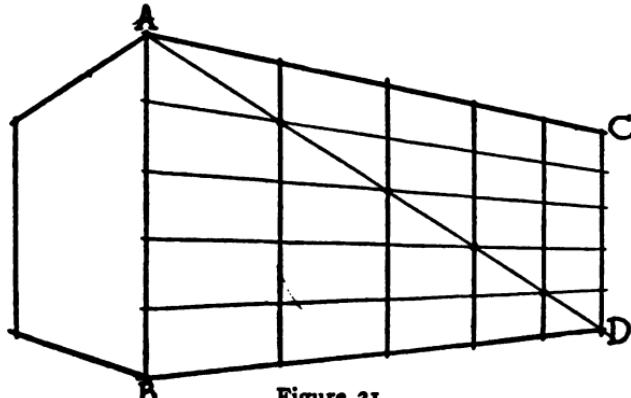


Figure 21
Odd Divisions in Perspective

OVER THE DRAWING BOARD

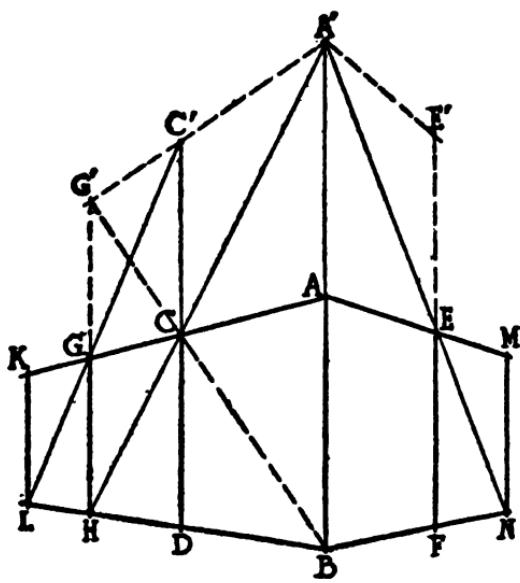


Figure 22
Diagonals for Measuring in Perspective

NOTE

S K E T C H E S

Diagonals for Measuring

Diagonals are also useful in drawing a series of equal spaces in perspective without the use of vanishing or measuring points. In Figure 22, the block AB-CD-EF is drawn in perspective. We may easily lay off any number of spaces perspectively equal to DB or BF by means of diagonals. If we continue BA to A', making A'A equal to AB, and continue DC to C', making C'C equal to DC, the rectangle A'ACC' will be perspectively equal to ABCD. Continuing its diagonal, A'C, to H and drawing the vertical HG, we get GC and HD, perspectively equal to each other and to CA and DB. In the same manner we may continue and find HL and GK and, on the other side, EM and FN.

It will be noticed that A'CH is really the diagonal of a rectangle of which C is the center.

Laying Out a Perspective Free-Hand

Figure 23 shows the application of these devices to the laying out of a small perspective, free-hand. It will be noticed how the centers for the gable end and for the location of windows were found by means of intersecting diagonals and how some of the measurements were made with a system of diagonals.

It is all really applying the short-cuts of geometric perspective with a great deal left to judg-

OVER THE DRAWING BOARD

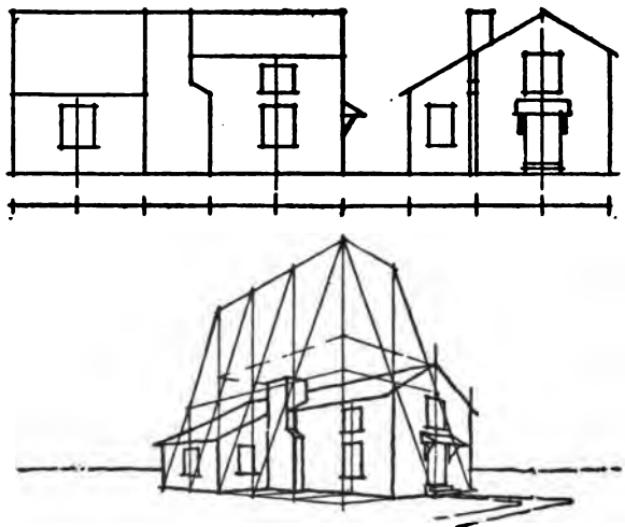


Figure 23
Laying Out a Free-Hand Perspective

S K E T C H E S

ment and the eye. With practice, the results will be pleasing and fairly accurate but never so sure as if carefully laid out, which is necessary if the perspective is to be of value in study of design, for in free-hand work we are very apt to draw things as we should like to have them look rather than as they will look and this brings us to a valuable dodge.

Inverting the Process of Perspective

We may draw an object in free hand perspective as we should like it to look and by an inverse process of perspective derive the plan and elevations of the object from this perspective. By continuing the converging lines we may find the vanishing points. We may assume the nearest corner as the vertical line of measures, find the measuring points in the usual way, project the perspective distances back to the front line in plan and knowing one or more of the principal dimensions, we may construct a scale by which we may measure the others. It is simply the inverted process—given a perspective we find the working points and actual dimensions instead of being given the actual dimensions, we find the working points and the perspective. Figure 24 illustrates this process applied to the perspective of a rectangular block, and the points are numbered in the order in which they are found.

OVER THE DRAWING BOARD

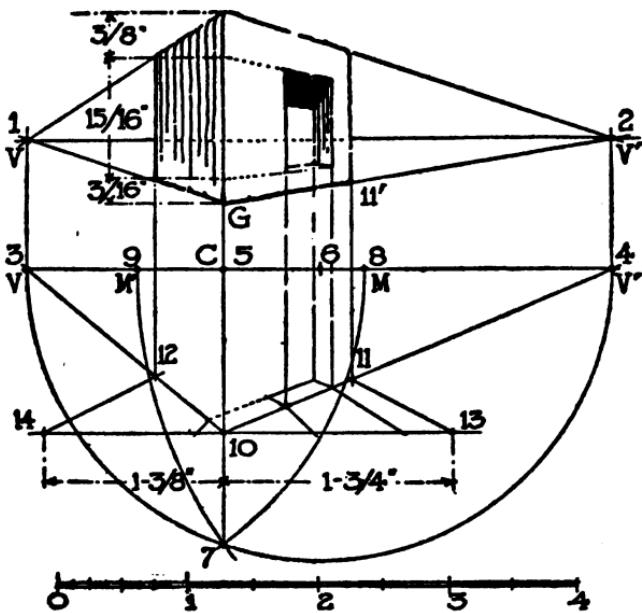


Figure 24
Inverting the Process of Perspective

S K E T C H E S

Example of Inverted Perspective

In Figure 24, we first find V and V' by continuing the converging lines and then draw the horizon line connecting them. Below we then draw another horizontal line and project V, V' and C, the nearest corner, on it. We find 6, the center of VV' and draw a semi-circle with 6 as center and 6V or 6V' as radius. On this semi-circle we project 7, the point of station, under C. With V and V' as centers and V-7 and V'-7 as radii, we strike arcs and find M and M', the measuring points. Assume 10 anywhere on C5-7 and draw through 10, a horizontal line. From 10 draw lines to V and V'. On these lines we may project any point of the perspective, like 11, and by drawing from M' through 11 to 13, find 10-13, the true length at the scale of the vertical line of measures, of the perspective line 10-11 or G-11' of the perspective picture. This is merely the converse of making a perspective as described in the third chapter of the "Perspective."

Constructing Plans and Elevations from Photographs

The same process of inverted perspective may be even more usefully applied to photographs. By continuing the converging horizontals we find the vanishing points. Assuming the nearest corner as the vertical line of measures we may find other

OVER THE DRAWING BOARD

working points and, at the scale of the photograph, construct the plan and elevations in so far as indicated in the photograph. If one or more of the actual dimensions are known, we may make a scale with which any dimension may be measured off the constructed plan and elevations.

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IX.

FILING OF DRAWINGS AND PLATES

Standard Size Sheets

The method of filing and keeping working drawings should receive serious consideration. The rolled drawing should be banished from the office. It is an all around nuisance. Drawings of miscellaneous sizes are also a nuisance and it is becoming customary to standardize the size of drawings. When a standard size sheet is adopted it is sometimes necessary to use a multiple of that size for an occasional large detail. These large sheets may then be folded to match the standard in size. For instance, 24" x 36" is very convenient, when necessary 36" x 48" is used. By folding the large sheets once they may be conveniently filed with the others.

Filing and Storing of Drawings

For filing, chests of drawers are the simplest but not the most convenient. Vertical-filing cases containing folders, envelopes or merely hangers for the bound drawings are very convenient and very compact. They may be obtained in many

Vertical Arrangement

OVER THE DRAWING BOARD

forms. For the storing of drawings in closets or vaults the best method is to use a hanger or binder for the edges of the drawings and to support the ends of these binders on rods running from wall to wall in the vault or closet. The binders may vary from the simple stick or strip of wood with the drawings fastened to it in some simple manner, to the clamp arrangement somewhat on the order of the device used for the filing of newspapers in libraries and clubs. The drawings may also be provided with eyelets and hung on S hooks which slide on rods.

Advantages of Vertical Filing

When it is considered that drawings may be filed in this way in two or three tiers and quite closely compacted, we see how the capacity of the ordinary closet or vault may become much enlarged. Above all things, this method in one form or another keeps the drawings flat, clean and easily accessible.

The whole filing and storing question becomes much complicated if the drawings vary greatly in size but the vertical system is flexible enough to allow considerable variation.

One Dimension of Sheets, Standard

The important thing to remember when using the binding strip and hanger method of storing

F I L I N G

and filing is to adopt a strip long enough to take the short dimension of the largest drawing to be filed. This, although wasting space when smaller drawings are stored, allows extreme variation in size when necessary. It is well, even when variation in size of drawings is necessary, to have one dimension of all drawings a definite size, say 30" or 36". This simplifies the buying of paper or cloth as well as the filing and storing while allowing adequate variation in size of the sheets themselves.

Treatment of Old Rolled Drawings

The most serious trouble is in the older offices where there is usually an accumulation of old drawings, stored long before the days of vertical filing, of every conceivable size, usually rolled tightly and extremely kinky and cranky. Tracing cloth will usually flatten itself out if laid flat on a board or table for a few days. Paper drawings and blue prints may be flattened by spreading out face down on a board, tacking the corners if necessary and then moistening the back with a sponge —they will dry quite flat. By sorting and folding, these old drawings may be conveniently filed vertically if not in the best manner, at least far better than if rolled.

Filing Plates, Photographs, Etc.

Every draftsman sooner or later runs into the

OVER THE DRAWING BOARD

problem of taking care of magazine plates, photographs, clippings and other reference material. The problem is two-fold. First we need a convenient, compact file, easy to use, and then a good index system which is expansive and simple. After personal experience with many systems of filing, such as small drawers, pigeon-hole cases with sliding shelves, portfolios and folders, loose leaf binders and others, the author has come to the conclusion that the large drawer, vertical file such as is used in the modern business office for correspondence and other purposes, is by far the best. It is very compact, perfectly flexible and may be indexed as elaborately as desired. It is somewhat difficult, as yet, to get cases with drawers large enough for the usual size plate (11" x 14") but they may be had or they may be made quite cheaply. Instead of chests of drawers, boxes made of wood or compo-board may be used. A sheet metal book-end such as is used in libraries may be used successfully for the "follower block." Small pictures or clippings may be grouped and mounted on sheets of thin card-board the same size as the plates and then filed with them.

Direct Index

In these drawers, the groups of plates are separated by pieces of cardboard having an index tab on top. These tabs may be indexed directly

F I L I N G

with the name of the subject matter of the group and arranged alphabetically or they may be numbered after some system and then referred to by means of a card-index.

Dewey Decimal System

A very comprehensive scheme of indexing is the Dewey Decimal System, amply explained by Dr. Dewey's own book. A bulletin of the University of Illinois—"An Extension of the Dewey Decimal System of Classification Applied to Architecture and Building" by N. Clifford Ricker is extremely valuable for the classification of all literature, from catalogs to photographs, usually found about the architect's office. The system is adaptable to the smallest as well as the largest collection.

Briefly described, the Dewey System divides all science, art and literature into ten classes as follows:

- 0 to 100 General works
- 100 to 200 Philosophy
- 200 to 300 Religion
- 300 to 400 Sociology and so on up to 1000, 700 to 800 covering Art.

Each one of these classes or centuries is divided into ten classes as under Art, 700; 710 is for

OVER THE DRAWING BOARD

Landscape Architecture, 720 is for architecture, 730 for Sculpture, and so on.

Each one of these subdivisions or decades is then divided into ten classes, as under 720, architecture; 721 represents construction; 722, Ancient; 723, Mediaeval; 724, Modern; 725, Public, and so on.

Example

Each one of these unit divisions may be further divided into tenths, hundredths and on so that the very nicest classification is possible, at the same time avoiding any confusion. For instance, 725.824 would signify a vaudeville theatre: 725 representing a public building of modern architecture, .8 qualifying this by denoting a recreation building and .02 further qualifying the recreation building as a theatre and .004 qualifying the theatre as a vaudeville house. There is no limit to the extension of this classification as the inventor's book or Dr. Ricker's bulletin will show.

Use

To use this classification to advantage each item to be filed must be numbered according to the system and filed numerically. When a certain subject is wanted, it needs only to be looked up in an alphabetical index, its characteristic number found and then all items pertaining to it may be readily picked from the numerically arranged files.

F I L I N G

The numbers being characteristic for different subjects, they are soon memorized with use and the index becomes a direct one, that is, requiring no supplementary reference index beyond the tabs on the guide or separation cards.

It would be a boon if all plates published in architectural magazines and all pamphlets sent out by manufacturers would have the Dewey system number printed in one corner. The system if once tried will probably never be dropped for it is well nigh limitless in its scope and almost fool-proof.

X.

PHOTOGRAPHY

Usefulness and Possibilities

Photography is extremely useful to the draftsman in many ways. Its pictorial possibilities are limited only by the knowledge of what a picture should be and the technical ability of the user.

Two Kinds of Photography

Its field readily divides itself into two parts: record photography, in which may be included photographs of detail and landscape accessories to be used later in the study of design or rendering, and pictorial photography, by means of which pictures may be made having much of the quality of etchings and fine lithographs. (Figures 25 and 26).

Record Photography

Record photography has been popularized so that anyone may indulge in it without inconvenience or muss—a dark room is no longer necessary for any of the ordinary processes of photography. Exposure has been simplified so that it has become automatic to give the right time. All the rest

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(From the *Journal of the A. I. A.*)

Figure 25
Pictorial Photography—Washington Square, New York

ARTS AND
APPLIED ARTS



(From the Journal of the A. I. A.)

Figure 26
Pictorial Photography—The Capitol, Washington

P H O T O G R A P H Y

may be easily done at home by means of automatic tanks and the very-easy-to-use gaslight papers or it may be turned over to commercial finishers who do the work quite cheaply.

General Recommendations

To him who wants to rise above mere record photography, we must recommend the doing of all his own finishing. The work will be a fascinating diversion from the routine of the drafting room and will prove profitable in many ways. Small negatives from which enlarged prints of various sizes may be made are recommended and all suggestions for apparatus and processes will be made on this basis.

The Camera

Unquestionably the ideal camera for the architectural student or draftsman is the so-called miniature one making a negative 2" x 3" or less in size on roll or pack film. These may be obtained with excellent lenses for from ten dollars up. As to lenses, extreme speed is not necessary. The only advantage of speed is the increased field of work—the faster the lens the less limited are the conditions under which one may work. For a negative from which enlargements are to be made, good definition is essential and a lens corrected for astigmatism is desirable.

OVER THE DRAWING BOARD

Exposure, Experiments

The best guide to exposure is experience and the best guide to experimenting is one of the many good exposure-meters on the market. If you want to get some real pictures, experiment on one subject—exposing not only as the meter directs but for one-fourth, one-half, twice and three times the time given by the meter. Compare the resulting negatives. A few such experiments will not be a waste of material but will provide an education in exposure and save many a film later.

Developing the Film or Plate

Developing of films and plates has been reduced to a very simple process. The tank method is practically automatic, does away with the dark room entirely when roll film is used and with pack films or plates it is only necessary to load the tank in the dark and any darkened room or closet serves the purpose. Tank development will get more out of 95 per cent of photographic exposures than any other treatment. It is the least mussy and the most convenient, besides as the manufacturer's say: "the experience is in the tank."

Minor Processes

The fixing, washing and drying of negatives need not be considered here. They are mere me-

P H O T O G R A P H Y

chanical processes explained thoroughly in the circulars accompanying every package of films or plates and in the booklets published by the several manufacturers.

Making the Print by Contact

Contact printing is a very simple process and need not be discussed here at length. The possibilities of the so-called "gas-light papers" like "Velox," "Cyko," "Azo," etc., are unlimited. Manufacturer's booklets explain the use of these papers very carefully. Experiments like the following will prove very interesting and instructive.

Valuable Experiments

Take a normal negative and ascertain the time it takes to make a good print from it, using normal developer and any standard brand of "gas-light" paper. Now make three prints exposing half the normal time, three prints exposing the normal time, and still three others exposing twice the normal time. Prepare three batches of developing solution, one normal, one half-strength and one double-strength. Develop one of each group of prints in each strength of developer. The nine different results will show some of the possibilities, using the same negative with one brand of paper and developer.

OVER THE DRAWING BOARD

Making the Print by Projection

The use of the enlarging lantern or stereopticon for making positive prints greatly enlarges the pictorial possibilities of photography. Briefly, the physical process of photographic enlargement is quite the same as that of showing a large picture on a screen by means of a lantern slide. The apparatus to be used is constructed in essentially the same way. Instead of the lantern slide we use the photographic negative, at the screen we use a sheet of sensitized paper, the light parts of the negative image on the paper darken its sensitized surface and on development we have the positive print. Experiments in exposure and development may be made exactly as we did in contact printing. "Gas-light" paper may be used but oftener the so-called "Bromide" papers, which are much faster, are preferable.

Advantages of Projection; "Painting with Light"

The advantages of printing by projection are numerous: prints of varying sizes and much enlarged may be made from the same negative which may be quite small; the print may be of any part of the original negative, a general and several detail prints may be made from the same negative; the definition may be varied at will and as much softness or "fuzziness" as desired may be had by simply changing the focus on the screen; the

LIGHT IN
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(From the Journal of the A. I. A.)

Figure 27

"Painting with Light"—
Lower Broadway, New York

THE VENUE
AUSTRALIA



Figure 28
A Detail Enlargement of a Part of a 2"x2" Negative

P H O T O G R A P H Y

image may be controlled by shading parts of it during exposure—these are only a few of the advantages and as one progresses he begins to realize that photography may be made a process of painting with light with the lens doing the drawing both mechanically and faithfully. (Figures 27 and 28).

Bibliography

It must be quite evident that the foregoing paragraphs were not intended as instruction in the science of photography, but rather as a few suggestions in the art of photography and its helpfulness to the draftsman and perhaps therefore to create interest and enthusiasm in that helpful art. The literature of photography is extensive. The catalogs, pamphlets, and instruction leaflets of the manufacturers of photographic apparatus and products are easily available and a very important part of this literature. Beginners will find "How to Make Good Pictures" published by the Eastman Kodak Co., a very useful little book. The "Exposure Meter and Photographic Diary," published annually by the Burroughs-Wellcome Co., is universally valuable. For more specialized information the "Photo Miniature" series of booklets on every phase of photography afford detailed instruction.

XI.

THE REPRODUCTIVE PROCESSES, PHOTO-ENGRAVING, ETCHING, WOOD ENGRAVING, LITHOGRAPHY

Every draftsman sometimes makes a drawing which is to be reproduced by printing. This is done from a plate made by what is called photo-engraving. Before the development of this method of graphic reproduction, drawings could be duplicated only by printing from metal plates as in copper and steel engraving and etching, or from wooden blocks produced by cutting or engraving, or from specially prepared stones as in lithography. Some of these processes, which will be briefly described, offer tempting diversions for the draftsman and it is interesting to note that many of the best draftsmen of all times have been engravers, etchers or lithographers.

The processes are of three classes: first, where the printing is to be done from lines and areas in type form or relief as in the photo-mechanical processes and wood cutting or engraving; second, where the printing is done from a plane surface as in lithography; and third, where the ink is

R E P R O D U C T I V E P R O C E S S E S

drawn from a grooved line as in etching and line engraving.

Photo-Engraving, Half-Tone and Line Cuts

To be used in a printing press, a block reproducing a drawing or picture must be in the nature of type, it must consist of a series of lines or dots or areas in relief, which may be inked and printed from on paper. Such blocks are produced by a combination of photography and the corrosion or etching of metal by means of acid solutions or other mordants.

Where the original drawing is in black ink on white paper and has no gradations or washes, it may be reproduced with a line cut, but where there are gradations or washes or where the lines are very fine, the half-tone cut must be used. To make a half-tone cut, the photographic negative is made with the aid of a screen interposed between the lens and the sensitive plate. This screen is transparent and cross ruled or cross hatched with opaque lines and renders the image of the original in masses or groups of dots of varying sizes and propinquity—small and widely spaced for the light tints, larger and more closely spaced for the darker areas, and practically in a continuous surface for the blacks. Drawings in pencil, charcoal or crayon may be reproduced by the half-tone process with a most charming softness.

OVER THE DRAWING BOARD

Drawings in color or on tinted or yellow paper do not make good half-tone cuts except by first making a photograph of the drawing on a color-sensitive plate, which reduces it to a monochrome with relatively correct tonal values. The half-tone may then be made successfully by using the photograph as the original.

Colored drawings may be reproduced in *color* by using the half-tone color process. In the three color process, half-tone plates or cuts are made from three negatives of the original, one taken through a violet screen, one through a green and one through an orange screen. Each one of these half-tone cuts is printed in ink whose color is the complementary of the color in the screen used for making the negative, that is, the first is printed in yellow ink, the second in red ink, and the third in blue. These printings are over each other and the colors combine to reproduce the colors of the original. From three to eight cuts and different colors of ink may be used—the more used, the more faithfully the colors of the original are reproduced.

Etching

In etching, a copper plate is prepared with an acid resisting coating. On this plate, the picture is scratched through to the metal. The back and the edges are coated and the whole immersed



(By Permission of the Journal of the A. I. A.)

Figure 29

Half-Tone Cut of Part of an Etching

By F. L. GRIGGS

(Same Size as Original)

R E P R O D U C T I V E P R O C E S S E S

in an acid or other corrosive solution. The scratched lines where the bare metal is exposed, are attacked by the mordant and eaten out to the desired depth after which the plate is cleaned, washed and dried and is ready for inking. It is inked with a dauber and wiped with tarlatan, which removes the ink from the surface but forces it into the etched lines. Printing is accomplished by placing a piece of dampened paper over the inked plate, covering with a pad and rolling through an etching press with considerable pressure. This forces the softened paper into the grooved lines of the plate, thus taking up the ink. The small quantity of ink remaining on the surface of the plate tones the ground of the print and considerable variation is possible through variation in inking, in the amount of ink left on various parts of the surface of the plate and the pressure used. The etched lines are subject to wear from the repeated wiping and pressure applied and after the first few impressions, the quality of the lines in the print deteriorates gradually. (See Figure 29).

In dry point etching, the picture is scratched directly on the copper surface and is printed from the burr raised by the scratching or etching needle. In this process no mordant is used.

OVER THE DRAWING BOARD

Wood Cutting and Engraving

The earliest printing was from wood. It is obvious that a square block of wood may be coated with black printing ink and a black square printed therefrom on paper. Instead of square, the edge of the block may be cut to any shape. A line *scratched* or *engraved* on the printing surface of this block will show *white* on the imprint. On these simple principles, wood cutting and engraving depend. Early wood cuts were in line only, with occasional masses of solid black. It meant simply making a drawing on the smooth surface of the wood and cutting away this surface except where the lines were, these being left in relief could be printed from in the ordinary way. Of course, this cutting was at times a very delicate operation. Wood cuts were made with a knife on a comparatively soft wooden block whose surface was cut with the grain. About 1820 wood engraving was invented. It differed from wood cutting in that the work was done with a graver on the *cross-grain* surface of a block of *hard* wood.

Just before the perfection of the photo-mechanical processes, wood engraving was most widely used for book and magazine illustrations. It became highly developed and really overreached itself, going beyond the natural



(By Courtesy of John Lane Co.)

Figure 30

Line Cut of Part of a Wood Engraving

By CLEMENCE HOUSMAN

(Same Size as Original)



R E P R O D U C T I V E P R O C E S S E S

limits of its own technique. It is quite easily seen that to print a black cross-hatch from a wooden block, the lines of the hatching must be left in relief on the block while the numberless little lozenges which show white between the lines on the print must be carefully cut out, one by one. This is obviously working counter to the nature of the process. Quite as obviously, the more natural technique is where the white line on the print, resulting from the engraved line on the block, is used to the utmost both for its own sake and to break up black areas into grays of more or less depth.

Wood cutting is a most interesting art, simple and within the reach of any draftsman. (See Figure 30).

Lithography

Perhaps the most fascinating of all the reproductive processes is lithography. The principle is extremely simple, depending on the fact that water and grease repel each other. On a fine-grained slab of a special kind of limestone, the drawing to be reproduced, and which was made with greasy crayon or ink, is either drawn directly or transferred from paper. The stone absorbs the grease from the crayon or ink so applied and is next thoroughly dampened, the greasy marks, of course, repelling the water. The whole is now

OVER THE DRAWING BOARD

inked several times with an ink roller. The greasy ink sticks to the greasy marks but is repelled by the wet surfaces. An impression in ink may be made on paper by pressing it in contact with the inked stone in a lithographic press.

Instead of drawing directly on the stone, the picture may be drawn on prepared transfer paper and by pressure transferred to the stone, thus having the advantage of not needing to be drawn in reverse. After the image is on the stone, it is flooded with dilute acid and gum solution for a time. This is erroneously called etching but really serves only to clean the unmarked surfaces of the stone and to dissolve certain ingredients of the ink or crayon used. Before inking all the coloring matter in the marks is washed off, the pigment being used only to make the marks on the stone or transfer paper discernible while drawing. Aluminum and zinc plates are also used for lithography, but the finest work is done on stone. (See Figure 31.)

Another method, much used for map work, is akin to engraving. The smooth surface of the stone is coated with gum solution and then blackened. When dry, the lines are scratched through this black coating, exposing the bare surface of the stone, which is then rubbed with grease, this being absorbed only by the bare lines and not



Figure 31
Half-Tone Cut of Part of a Lithograph
By RICHARD PARKES BONINGTON
(Same Size as Original)



R E P R O D U C T I V E P R O C E S S E S

penetrating the coating. The coating is washed off and the stone thoroughly dampened, the greased lines repelling the water. The ink which is now applied, sticks only to the greasy lines as in regular lithography.

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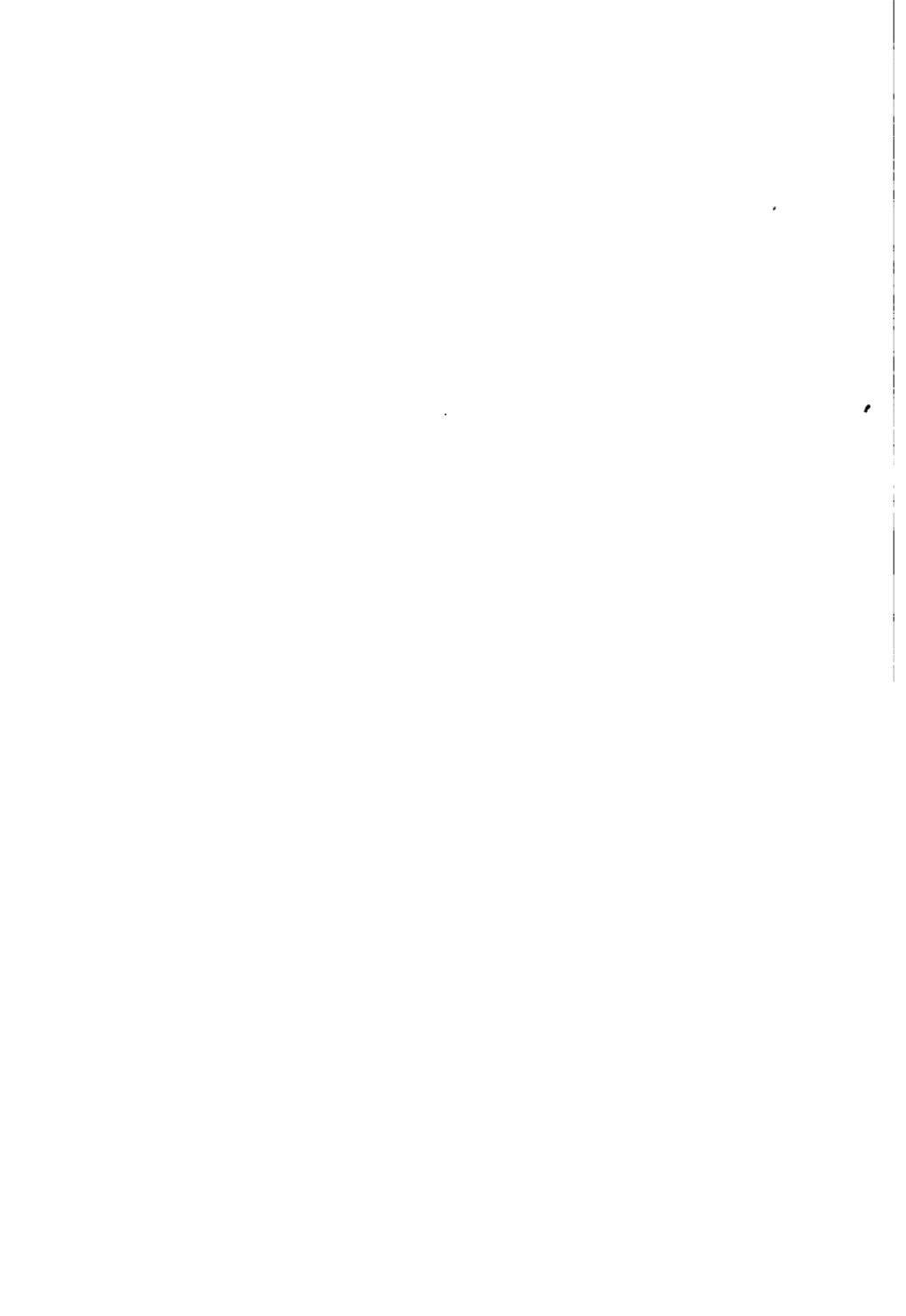
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INDEX

	PAGE
<hr/>	
A	
Adjustable Triangles	41
Aids in Free-hand Perspective.....	91
All-over or Solid Mounting of Drawings	19
Applied Bands	27
Approximation, Ellipse by	43
Approximation, Oval by	46
Approximation, Rake Ellipse by	44
Approximation, Spiral Curves by	50
Arcs, Tangency of	42
B	
Bands, Applied	27
Bibliography of Photography	113
Bibliography of Reproductive Processes	121
Blue-prints for Office Copies	79
Blue-prints, Shrinkage of	72
Blue-prints, Tracings and	63
Board, Mounting on Compo-	21
Boards, Cleaning after Stretch-Mounting	17
Boards, Drawing	7
Borders and Mats	25
Borders and Mats, Mitered	26
Brown Ink	82
Brush Technique	89
C	
Camera, Choice of	109
Centers in Perspective	91
Charcoal Drawings on Tracing-Paper, Mr. Platt's.....	31
Cleaning of Boards after Stretch-Mounting	17
Cloth, Tracing (see Tracing Cloth or Linen)	36
Cloth, Tracing Paper versus	33
Color, Experiments in	83
Color to Indicate Materials	74
Colored Inks to Indicate Materials, Watered and	76
Colors or Pigments, Selection of	85

PAGE

Colors, Settlement in Water	89
Colors, Transparent and Opaque	87
Colors, Water	83
Compasses and Dividers	9
Compo-board, Mounting on	21
Composition, Essentials of	87, 88
Contact Prints, Photographic	111
Copying, Squaring in	33
Corners and Intersections of Lines	67
Corners, Numbering in all Four	62
Corners, Sticking Down in Mounting	18
Covers for Drawings	3
Cross-Section Paper, Squared or	32
Curling of Mount, Prevention	19

D

Demounting Tracings	25
Detail Drawings, General and	69
Detail Drawings, Making the New Way	71
Detail Drawings, Making the Old Way	70
Details, Full Size	71
Details, Studying of	73
Details, Symmetrical	72
Development in Photography	110
Dewey Decimal System	105
Diagonals, Use of in Perspective	91
Diluted Inks, Watered or	13
Dimensioning of Drawings	77
Dimensioning, Practical Requirements of	77
Dimension of One Side of Sheet, Standard	102
Direct Index for Files	104
Dividers, Compasses and	9
Dividing a Line into Equal Parts	39
Divisions, Even, in Perspective	92
Divisions, Odd, in Perspective	92
Drafting Room, Full-Size Scales in	7
Drafting Room, Furniture in	6
Drafting Room, Light in	5
Drafting Room, Ventilation of	5
Drafting Room, Water in	3
Drawing as a Language	2
Drawing Boards	7
Drawing Tables	7
Drawings, General and Detail	69

PAGE

Drawings, Monochrome	89
Drawings, Original	64
Drawings, Working—Function of	63

E

Elevations from Photographs, Constructing Plans and	99
Ellipse and Oval	41
Ellipse by Approximation	43, 44
Ellipse, Drawing of True	48
Ellipse, Drawing of True by Straight-Edge Method	50
Ellipse, Drawing of True by String Method	48
Engraving, Photo-.....	115
Engraving, Wood	118
Enlargement of Drawing, Photo-.....	82
Equal Distances, Laying off	41
Equal Parts, Dividing a Line into	39
Erasers	11
Erasing, Light Rubbing in	12
Erasing Shield	12
Essentials of Composition	88
Etching	116
Even Divisions in Perspective	92
Experiments in Color	83
Exposure in Photography	110

F

Filing and Storing of Drawings	101
Filing of Drawings, Advantages of Vertical.....	102
Filing Plates and Photographs	103
Filing Plates and Photographs, Vertical	103
Formal Studies	88
Free-hand Lettering, A Method of	55
Free-hand Perspective	90
Free-hand Perspective, Aids in	91
Free-hand Perspective, Laying Out a	95
"Frothing" with Tracing Paper	34
Full-Size Details	71
Full-Size Scales in Drafting Room	7
Function of the Tracing	36
Function of Working Drawings	63
Furniture in Drafting Room	6

	PAGE
G	
General and Detail Drawings	69
Geometry, Value of	39
Glass, Tinted	25
Guide Lines for Free-hand Lettering	54
H	
Half-Tone Cuts	115
Handling of Tracing Cloth	37
Hatching to Indicate Materials	74
I	
Index for Files, Direct	104
Indicate Materials, Color to	74
Indicate Materials, Hatching to	74
Indicate Materials, Standard Symbols to	74
Indicate Materials, Watered and Colored Ink to	76
Indication vs. Representation	66
Ink, Brown	82
Ink, Watered or Diluted	11
Instruments and Materials	3
Instruments, Quality of	3
Intersections of Lines, Corners and	67
Inverted Perspective, Example of	99
Inverting the Process of Perspective	97
L	
Laying off Equal Distances	41
Laying Out a Perspective Free-hand	95
Lettering	54
Lettering Backwards	58
Lettering, A Method of Free-hand	55
Lettering, Guide lines for and Spacing of	54
Light in Drafting Room	5
Light, Painting with	112
Line Cuts	115
Lines, Guide for Lettering	54
Lithography	119
M	
Materials, Color to Indicate	74
Materials, Hatching to Indicate	74
Materials, Standard Symbols to Indicate	74

	PAGE
Materials, Watered and Colored Inks to Indicate	76
Mats, Borders and.....	25
Mats, Mitered Borders and	26
Measured Drawings, Squared or Cross-section Paper in...	32
Measuring in Perspective, Diagonals for.....	95
Media for Sketches, Paper and	80
Mirror in Symmetrical Drawing, Use of	73
Mitered Borders and Mats	26
Modification of Color by Color of Mount	25
Monochrome Drawings	89
Mount, Keeping Straight	17, 19
Mounted Tracings, Advantage of	23
Mounting Drawings, All-over or Solid.....	19
Mounting Drawings by Sticking Down Corners	18
Mounting Drawings on Compo-board	21
Mounting Drawings on Stretchers	20
Mounting Drawings, Trimming and	18
Mounting of Paper, All-over or Solid.....	16
Mounting of Tracing Paper, All-over or Solid	22
Mounting, Stretch (see Stretch-Mounting)	
N	
Newels, Method of Drawing Scroll	50
Notes on Drawings; Specifications	78
Numbering in all Corners of Sheet.....	62
Numbering, Systems of	61
Numbers, Tracing of Titles and	59
O	
Odd Divisions in Perspective	92
Office Copies, Blue-prints for	79
Office Copies, Original Tracings Not to Be Used as	78
Old Rolled Drawings, Treatment of	103
Opaque Colors, Transparent and	87
Original Drawings	64
Original Drawings, Titling of	62
Original Tracings Not to Be Used as Office Copies	78
Oval and Ellipse	41
Oval by Approximation	46
P	
Painting, Tinted Outline vs.	86
Painting with Light	112
Paper for Pencil	81

	PAGE
Paper and Media for Sketching	20
Paper, Tracing (see Tracing Paper)	22
Pen and Ink	22
Pencil, Paper for	21
Pencil and Tinting, Soft	21
Pencils	10
Pens, Ruling	9
Pens, Sharpening of Ruling	10
Perspective, Aids in Free-hand	91
Perspective, Centers in	91
Perspective, Diagonals for Measuring in	95
Perspective, Diagonals in	91
Perspective, Even Divisions in	92
Perspective, Example of Inverted	99
Perspective, Free-hand	90
Perspective, Geometric	90
Perspective, Inverting the Process of	97
Perspective, Laying Out a Free-hand	95
Perspective, Odd Divisions in	92
Photo-Engraving	115
Photo-enlargement of Drawing	82
Photographs, Constructing Plans and Elevations from	99
Photographs, Filing of Plates and	103
Photographs of Drawings for Reference	79
Photography, Bibliography of	113
Photography, Pictorial	108
Photography, Record	108
Photography, Two Kinds of	108
Pigments or Colors, Selection of	85
Plans and Elevations from Photographs	99
Platt's, Mr. Charcoal Drawings on Tracing Paper	31
Powdering Surface of Tracing Cloth	37
Preparation of Sheets for Drawing	62
Print, Tracing and Blue	63
Printing Titles from Zinc Cuts	60
Print-roller, Use of Photographic	17
Prints, Blue- for Office Copies	79
Prints, Photographic by Contact	111
Prints, Photographic by Projection	112
Projection, Advantages of Photographic	112

R

Rake Ellipse by Approximation	44
Record Photography	108

	PAGE
Rendering on Tracing Paper	31
Representation, Indication vs.	66
Reproductive Processes	114
Reproductive Processes, Bibliography	121
Rolled Drawings, Treatment of Old	103
Roller, Use of Photographic Print	17
Rolls of Tracing Paper, Short	30
Rubber Stamps for Titles	60
Rubbing in Erasing, Light	12
Ruling Pens	9
Ruling Pens, Sharpening of	10

S

Scale Drawings, Studying of	68
Scale of Indications	76
Scales	9
Scales in Drafting Room, Full-size	7
Scales of Working Drawings	65
Scraper, Use of Wall	17
Scroll Newels, Method of Drawing	50
Settlement in Water-colors	89
Shades and Shadows	88
Sharpening of Ruling Pens	10
Shield, Erasing	12
Short Rolls of Tracing Paper	30
Shrinkage of Blue-prints	72
Silhouette Lines	67
Size of Sheets, Standard	101
Sketches, Character of Studies and	80
Sketches, Paper and Media for	80
Sketching, Squared and Cross-section Paper in	32
Soft Pencil and Tinting	81
Spacing of Lettering	54, 58
Specifications and Notes on Drawings	78
Spiral Curves by Approximation	50
Squared or Cross-section Paper	32
Squares, T-	8
Squaring in Copying	33
Stamps for Titles, Rubber	60
Standard, One Dimension of Sheet	102
Standard Size of Sheets	101
Standard Symbols to Indicate Materials	74
Sticking Down Corners for Mounting	18
Storing of Drawings, Filing and	101

PAGE

Straight, Keeping Mount	29
Straight-Edge Method of Drawing Ellipse.....	30
Stretchers, Mouting on	20
Stretch-mounting, General Process of	14
Stretch-mounting Heavy Paper	14
Stretch-mounting Tracing Paper	24
Stretch-mounting versus Thumb-tacks	13
Stretch-mounting, Very Heavy Paper	15
Stretch-Mounting, Very Thin Paper	16
String Method of Drawing Ellipse	48
Studies and Sketches, Character of	80
Studies, Formal	88
Studying Details	73
Studying on Tracing Paper	29, 30
Studying Scale Drawings	68
Symbols to Indicate Materials	74
Symmetrical Details	72
Symmetrical Drawing, Mirror in	73

T

Tables, Drawing	7
Tacking of Tracing Cloth	37, 38
Tangency of Arcs	42
Thumb-tacks, Stretch Mounting vs.	13
Tinted Glass	25
Tinted Outline vs. Painting	86
Titling of Drawings	59
Titling of Originals	62
Titles and Numbers, Tracing of	59
Titles, Printing from Zinc-cuts	60
Titles, Rubber Stamps for	60
Tracing and Blue-print	63
Tracing Cloth, Handling of	37
Tracing Cloth or Linen	36
Tracing Cloth, Powdering Surface of	37
Tracing Cloth, Tacking of	37, 38
Tracing, Function of	36
Tracing of Titles and Numbers	59
Tracing Paper, All-over or Solid Mounting of	22
Tracing Paper, "Frothing" with	34
Tracing Paper, General Uses of	29
Tracing Paper, How to Use in Studying	29, 30
Tracing Paper, Rendering on	31
Tracing Paper, Short Rolls of	30

	PAGE
Tracing Paper, Stretch-Mounting of	24
Tracing Paper, Transferring with	34
Tracing Paper vs. Cloth	33
Tracings, Advantage of Mounted	23
Tracings, Demounting of	23
Tracings Not to be Used as Office Copies, Original	78
Transferring with Tracing Paper	34
Transparent and Opaque Colors	87
Triangles	8
Triangles, Adjustable	41
Triangles, 45°	41
Triangles, 30° and 60°	41
Trimming and Mounting Drawings	18
T-Squares	8

V

Ventilation of Drafting Room	5
Vertical Filing of Drawings, Advantage of	102
Vertical Filing of Plates and Photographs	103

W

Wall Scraper, Use of	17
Water Colors	83
Water Colors, Settlement in	89
Watered and Colored Inks to Indicate Materials	76
Watered or Diluted Ink	11
Water in Drafting Room	8
Wood Cutting	118
Wood Engraving	118
Working Drawings, Function of	63
Working Drawings, Scales of	65

Z

Zinc-cuts for Printing Titles	69
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